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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Office of General Counsel, GCNW
7600 Sand Point Way N.E.,
Seattle, Washington 98115-6349

June 27, 2002

RECEIVED
JUL 1 2002

Magalie R. Salas, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Subject: Lewis River, Project Nos. 935, 2071, 2111, 2213

Dear Secretary Salas:

Enclosed for filing please find the original and (14) copies of the National Marine Fisheries Service's and U.S. Fish and Wildlife Service's Endangered Species Act Biological Opinion regarding proposed interim operation of the above referenced project and certificate of service.

Sincerely,

Margaret E. Delp

Margaret E. Delp
Attorney Advisor
(206) 526-6153

Enclosures

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

PacifiCorp and Cowlitz PUD	)	Project Nos. 935, 2071, 2111, 2213
	)	(Lewis River Hydroelectric Projects)
License Amendment	)	
	)	

CERTIFICATE OF SERVICE

I hereby certify that I have this day served, by first class mail, the National Marine Fisheries Service's and U.S. Fish and Wildlife Service's Endangered Species Act Biological Opinion regarding proposed interim operation of the above referenced project, cover letter to Magalie Salas, FERC, and this Certificate of Service upon each person designated on the official service list compiled by the Commission in the above captioned proceeding.

Dated this 27th day of June, 2002.

Margaret E. Delp

Margaret E. Delp

Endangered Species Act - Section 7 Consultation

Biological Opinion

for the

Interim Operation of the
Lewis River Hydroelectric Projects

Merwin FERC No. 935
Yale FERC No. 2071
Swift 1 FERC No. 2111
Swift 2 FERC No. 2213

Action Agency: Federal Energy Regulatory Commission

Conducted by:
United States Department of Interior
U.S. Fish and Wildlife Service
Western Washington Fish and Wildlife Office
510 Desmond Dr. SE. Suite 102
Lacey, WA 98503-1273

United States Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
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J. Mark Robinson, Director
Division of Environmental and Engineering Review
Federal Energy Regulatory Commission
888 First Street, NE
Washington, D.C. 20426

FWS Reference:1-3-01-F-0070
NMFS Reference: F/NWR/2000/01437

Dear Mr. Robinson:

This document transmits the U.S. Fish and Wildlife Service's and National Marine Fisheries Service's (the Services') biological opinion on the effects to the Columbia River distinct population segment (DPS) of the bull trout, and evolutionarily significant units (ESUs) of the Lower Columbia River chinook salmon, Lower Columbia River steelhead, and Columbia River chum salmon from the continued operations of the Merwin, Yale, Swift No. 1 and Swift No. 2 hydroelectric projects. It considers the effects of implementing the amendment to these licenses applied for on July 6 and August 17, 2000, by the licensees of these projects. These projects are licensed by the Federal Energy Regulatory Commission (FERC) and have FERC numbers 935, 2071, 2111 and 2213 respectively. Merwin, Yale, and Swift No.1 are owned and operated by PacifiCorp. Public Utility District No.1 of Cowlitz County (Cowlitz PUD) owns the Swift No. 2 project and PacifiCorp performs designated operation functions for Cowlitz PUD for the project under contract. This consultation is being provided in accordance with section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.) and implementing regulations found at 50 CFR Part 502.

The NMFS is providing to you, under separate cover, a corresponding consultation under the Magnuson-Stevens Fishery Conservation and Management Act, which includes conservation recommendations for reducing project impacts on essential habitat of chinook salmon and coho salmon. These recommendations are identical to the elements of the proposed action and reasonable and prudent measures described in this biological opinion for anadromous fish.

The FERC determined, through the applicants PacifiCorp and Cowlitz PUD, that the action is likely to adversely affect the bull trout (*Salvelinus confluentus*), and is not likely to jeopardize the continued existence of the SW Washington Columbia River DPS of coastal cutthroat trout (*Oncorhynchus clarki clarki*). The U.S. Fish and Wildlife Service (FWS) concurs with these determinations. Therefore, the coastal cutthroat trout will not be addressed further in this biological opinion.

Further, based on the analysis and conclusions in the biological assessment, FERC concluded that the action is likely to adversely affect Lower Columbia River chinook salmon

(*Oncorhynchus tshawytscha),* Lower Columbia River steelhead (*Oncorhynchus mykiss*) and Columbia River chum (*Oncorhynchus keta).* The National Marine Fisheries Service (NMFS) concurs with these determinations.

The FERC also concluded that the proposed action is not likely to adversely affect the Southwest/Columbia River coho salmon (*Oncorhynchus kisutch*). Conferencing is required for proposed species when the action agency determines that its action is likely to jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat. There is no need to confer further on the Southwest/Columbia River coho since it has no listing status.

This consultation concerns only the proposed and listed fish species in the project area. It does not look at project effects on the proposed and listed non-fish species. A list of those species was enclosed with our letters of April 2, 1999, and June 9, 1999, to PacifiCorp and Cowlitz PUD respectively and was included as Appendix A in FERC's biological assessment (BA). As the Federal Agency responsible for licensing the projects, FERC should initiate consultation on the terrestrial species listed in Appendix A.

This biological opinion is based on information provided in the BA and the environmental assessment (EA) for the proposed license amendment received in our offices on October 10, 2000; meeting notes; telephone and meeting conversations with participants in the relicensing process; relicensing study results; field trips; the proposed and final rules for listing of bull trout; and other sources of information. The administrative record of this consultation is on file at NMFS and FWS offices listed on the signature page.

OBJECTIVE

The objective of this biological opinion is for the Services to determine whether FERC's proposed authorization of the interim operation of PacifiCorp's and Cowlitz PUD's Lewis River hydroelectric projects through 2006, are likely to jeopardize the continued existence of ESA-listed species, or result in the destruction or adverse modification of designated critical habitat. The standards for determining jeopardy are set forth in section 7(a)(2) of the ESA, 16 U.S.C. § 1531, et seq., and its implementing regulations, 50 CFR § 402 (the consultation regulations). Procedures for conducting consultation under section 7 of the ESA are further described in the Services' Consultation Handbook (USFWS and NMFS 1998). The general approach for conducting a jeopardy analysis, the method used to apply the jeopardy analysis in this opinion, and the spatial and temporal scales in the jeopardy analysis are described below. Formal consultation will be concluded with the final issuance of this opinion.

GENERAL APPROACH FOR JEOPARDY ANALYSIS

The Services must determine whether the action is likely to jeopardize the listed species and/or destroy or adversely modify designated critical habitat. To that end, we perform an analysis that (1) defines the biological requirements and current status of the listed species; (2) describes the effects of the environmental baseline within the action area; (3) evaluates the effects of the proposed action on the listed species; (4) considers the cumulative effects of the future state, Tribal, local, or private actions that are reasonably likely to occur within the action area; and, (5) determines if the proposed action, together with the environmental baseline and cumulative effects, is likely to jeopardize the continued existence of the listed species within an evolutionarily significant unit (ESU) or distinct population segment (DPS) or result in the destruction or adverse modification of its designated critical habitat.

If the effects of the proposed action, taken together with the cumulative effects and baseline, are found to jeopardize the listed species, or destroy or adversely modify critical habitat, then the Services must identify any reasonable and prudent alternatives to the proposed action that will avoid jeopardy or adverse modification of critical habitat. The Services define an action that is "likely to jeopardize the continued existence of" as one that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR §402.02). NMFS has interpreted the implementing regulations as requiring a high likelihood of survival and moderate to high likelihood of recovery when the proposed action is combined with mortality in other life stages (see Section 1.3.1.1 in the 2000 FCRPS Biological Opinion).

The framework used to apply a jeopardy analysis in any given section 7 consultation varies depending on the type of action analyzed and the availability of information regarding the effects of the action on listed species. Biological requirements may be expressed either in terms of survival rates and metrics indicating population viability or as habitat conditions necessary to ensure the continued existence of the species. The Services assert that these two approaches are equivalent based on studies that identify causal links between habitat modifications and population characteristics such as abundance, productivity, and diversity. This causal relationship can be quantified under certain specific conditions (e.g., Spence et al. 1996), although site-specific information is not available in the context of most section 7 consultations. In these instances, the Services must rely on data that can reasonably be extrapolated to the action area and to the populations in question.

In this biological opinion, the Services look at both short and long-term and small and large-spatial-scale effects of the proposed action. Actions lasting for even a short period of time, or affecting only a small portion of the action area, can have some degree of adverse effect on habitat processes that support numbers, reproduction, and distribution. The Services must use their professional judgement to determine whether this type of adverse effect, when added to the current status of the species and its habitat in the action area (environmental baseline) and to the effects of other foreseeable actions (cumulative effects), would constitute jeopardy.

The analysis in this biological opinion analyzes the effects of the action through 2006, the date of expiration of the Merwin, Swift No. 1 and Swift No. 2 licenses. Note, the Yale project's license expired in 2001. The Services hold the reasonable expectation that this biological opinion will be superseded by a subsequent one upon issuance of new licenses in 2006. If FERC has not issued new licenses by April, 2006, the Services expect that reinitiation of consultation would be required based on the regulatory requirements set forth at 50 C.F.R. 402.16. If the Services determine that reinitiation is warranted, but consultation is not reinitiated for whatever reason, this biological opinion and incidental take statement shall no longer be in effect beyond April, 2006. If the Services determine that re-initiation is warranted, PacifiCorp and Cowlitz PUD consent to the consultation and shall remain in compliance under the current ITS until consultation is completed.

The Services have analyzed the proposed interim measures, which would mitigate for some project impacts, increasing the likelihood of survival and recovery of the species. Areas for additional study have been identified. To the extent that these studies provide information to formulate additional mitigation, such mitigation will be included in the settlement agreement and implemented during the new license terms.

CONSULTATION HISTORY

The FWS has been working with PacifiCorp since 1995 on the relicensing of the Yale hydroelectric project. In 1998, NMFS joined PacifiCorp and other participants in the relicensing when it was decided to expand the studies and scope of the analysis to include the remaining three hydroelectric projects on the North Fork Lewis River watershed. Cowlitz PUD, as the owner of the Swift No. 2 project, then became involved with the relicensing. The licensees, agencies, and other interested parties agreed to use the Alternative Licensing Process (ALP) for relicensing all of the Lewis River projects. This process is a more collaborative approach than the traditional relicensing process and allows for a more thorough discussion of the issues before FERC completes their environmental analysis.

In July, 1999, PacifiCorp and Cowlitz PUD requested a meeting with the U.S. Fish and Wildlife Service, National Marine Fisheries Service (NMFS), and the Federal Energy Regulatory Commission (FERC) to discuss a proposal for habitat protection measures designed to conserve salmon, steelhead and bull trout. The objective was to obtain authorization for incidental take under section 7 of the ESA for the operations of the Lewis River projects. It was understood that this incidental take protection was desired for the period of time between now and when consultation for the new license is complete. Several key studies will be concluded by that time that will allow a more complete understanding of bull trout status and needs in the Lewis River. At the July 1999 meeting, the Services agreed to review a draft biological assessment (BA) to be prepared by PacifiCorp and Cowlitz PUD, which would then be filed with the FERC along with the proposed applications for license amendments. This proposal, as modified by subsequent review, is discussed below as the description of proposed action. The Services participated in several meetings, teleconferences and informal discussions to discuss the proposal and to suggest modifications to the BA. Concurrently, PacifiCorp and Cowlitz PUD were negotiating on a joint consultation process that would meet both of their needs.

On July 6, 2000, PacifiCorp filed a draft single party BA and application with FERC to amend its licenses for Merwin, Yale and Swift No. 1 Hydroelectric Projects. Negotiations between the two licensees continued and resulted in a joint draft BA on August 16, 2000.

On August 16, 2000, PacifiCorp filed an amended application for amendment of PacifiCorp licenses, and included a revised Exhibit E, a revised BA and a revised EA. PacifiCorp requested that these documents be substituted for the BA and EA attached to the July 6, 2000 application. On August 16, 2000, Cowlitz PUD filed an application to amend its license for the Swift No. 2 Hydroelectric Project, also on the Lewis River.

FERC sent a letter to initiate formal consultation with the Services on October 4, 2000. NMFS considered consultation initiated as of that date. After review of the consultation package, the FWS believed that additional information was needed before formal consultation could be initiated. On December 15, 2000, FERC sent the FWS a letter with some of the additional information requested. According to PacifiCorp and FERC, no additional information was available other than that provided in FERC's December 15 response. The FWS received this letter from FERC on December 27, 2000, and initiated formal consultation as of that date.

BIOLOGICAL AND CONFERENCE OPINION

DESCRIPTION OF THE PROPOSED ACTION

The proposed action is described in FERC's BA as: (1) operation of the projects as defined under existing FERC licenses; (2) certain modified operations under the August 16, 2000, proposed license amendments for the projects; (3) conservation measures that have been committed to by Applicants and are included in proposed license amendments and FERC's BA; and (4) commitment to engage in studies that will address existing data gaps. By filling such data gaps, the ALP will be more effective in developing and analyzing the best available scientific information.

PacifiCorp and Cowlitz PUD requested FERC's approval to incorporate within their existing licenses the interim ESA measures contained in their BA filed August 16, 2000. These measures are intended to provide PacifiCorp and Cowlitz PUD with ESA compliance for the Merwin, Yale, and Swift No. 1 and Swift No. 2 Hydroelectric Projects until 2006, the date at which all projects licenses will be expired and identified in the ALP as the goal for new licenses. The license amendments include measures that: (1) protect habitat through conservation easements and land purchases; (2) reduce potential fish stranding with equipment upgrades and additional system back-ups; (3) minimize impacts from project roads; and, (4) reduce total dissolved gas levels in the upper projects. PacifiCorp and Cowlitz PUD aim to avoid or minimize the effects of incidental take of listed and proposed species that occur as a result of current facility operations.

Further, such measures represent important near-term conservation opportunities that may be lost if not secured while collaboratively developing long-term conservation measures. These measures are not intended to pre-judge the results of ongoing watershed studies or final conservation strategies developed during the relicensing process. Additional information will be developed during the ALP and resulting measures will be implemented through a final licensing settlement agreement and/or as terms and conditions for each new license.

PROJECT LOCATION AND DESCRIPTION

The action area is located on the North Fork Lewis River, a major tributary to the Columbia River. It extends into Clark, Cowlitz, and Skamania Counties, Washington from Mt. Adams to the confluence with the Columbia River. The layout and sequence of the projects of the four hydroelectric projects in the action area are shown Figure 1. The projects begin 10 miles east of Woodland, Washington. The projects use North Fork Lewis River water from elevation 50 feet mean sea level (msl) at the Merwin Project tailwater to 1,000 feet msl at Swift No. 1 normal pool.

The Merwin, Yale, and Swift No.1 projects represent a linked reservoir/ powerhouse system covering over 30 miles of the Lewis. The Swift No. 2 project does not include a dam and reservoir. It uses water directly from the tailrace of Swift No.1 and discharges through the Swift No. 2 powerhouse into Yale Lake. The operation of the Merwin Project is coordinated with operation of the other three North Fork Lewis River projects. It acts as a "re-regulation" project by providing a more stable flow downstream of the project (See Table 1). Yale and Swift No. 1 are operated as peaking facilities, i.e., coming on-line during peak power demands, and also providing flood regulation in the basin. Therefore, Yale and Swift reservoirs are drawn down during winter months to provide for flood storage.

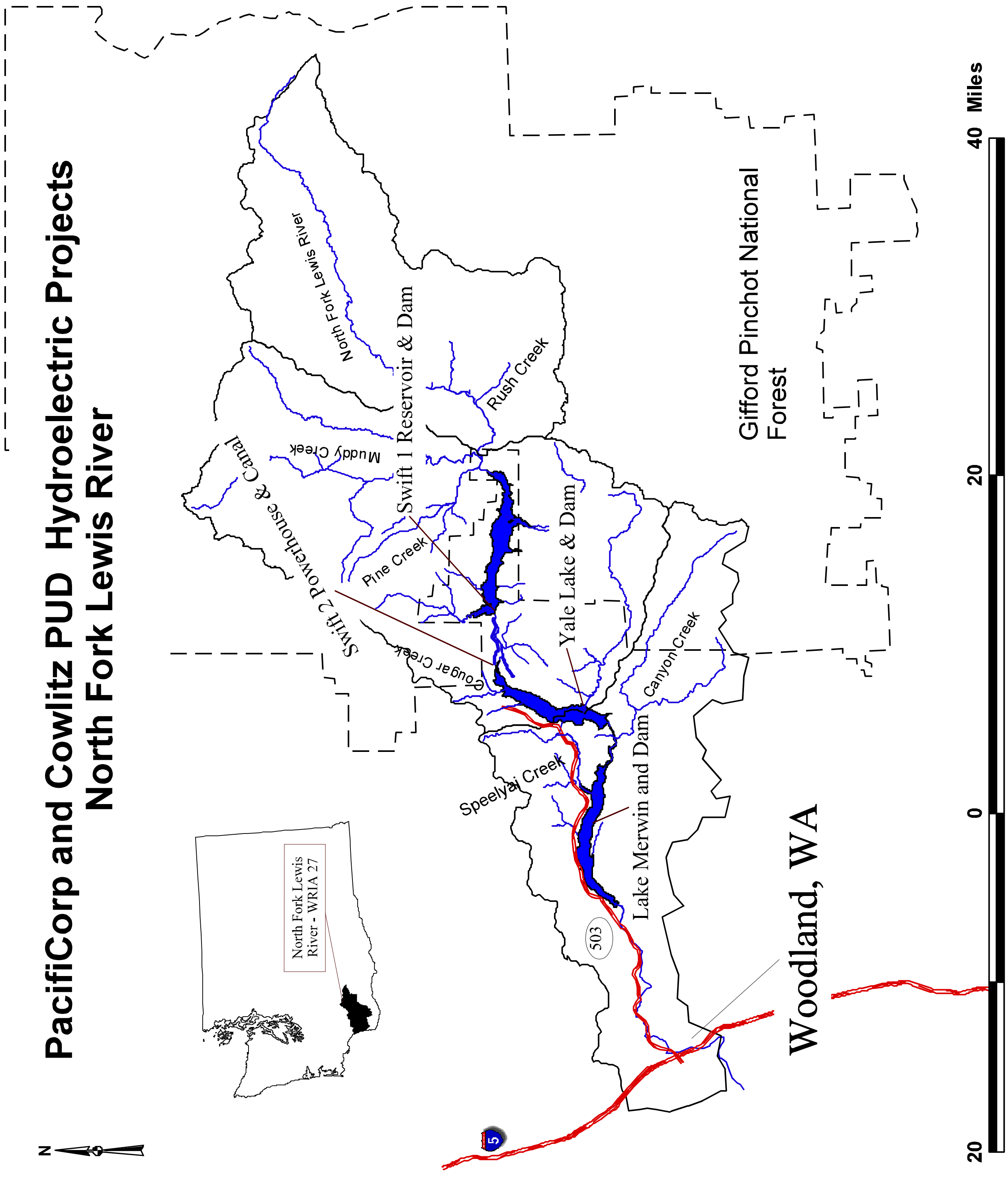

Figure 1 Action Area

Map Sources:

WDNR (Roads, Streams and WRIA basins)
WDFW (Lakes)
USFS (Administrative boundary)

Merwin. FERC No. 935

Merwin Dam is a 136 megawatt (MW) plant located on the North Fork Lewis River approximately 20 miles upstream from its confluence with the Columbia River. The dam is a concrete arch structure with a total crest length of 1,300 feet and a maximum height above its lowest foundation of 314 feet. The project ranges in elevation from 50 feet msl to full pool at 239.6 feet msl. It can generate from full pool down to its allowable minimum level of 165 feet msl. The normal minimum pool elevation is 235 msl.

The reservoir formed by Merwin Dam is about 14.5 miles long with a surface area of approximately 4,000 acres. At full pool, the reservoir has a gross storage capacity of approximately 422,800 acre-feet. The general operation of the Merwin Project is regulated by FERC license articles 43 and 49 and by a Federal Emergency Management Agency agreement. As a flood control measure, FERC license article 43 stipulates that PacifiCorp must provide a total storage space of not less than 70,000 acre-feet combined for all three reservoirs between November 1 and April 1. The article does allow the reservoirs to be filled gradually during the month of April and held at near maximum pool between April 30 and September 20. After September 20, the reservoirs must be gradually lowered to the minimum storage level of 70,000 acre-feet.

Table 1. Minimum flows and ramping rates below Merwin powerhouse, as stipulated in license Article 49.

Time Period	Minimum Flow Requirement	Ramping Rate Requirement
December 8 - February 28	Constant minimum flow of 1,500 cfs	Up-ramping not to exceed 1.0 feet per hour in river stage in the North Fork Lewis River at the USGS gage at Ariel. Down-ramping not to exceed 1.5 feet per hour in river stage at the Ariel gage.
March 1 - May 31	March = 1,000 - 2,000 cfs, depending on 3/1 runoff forecast. April = 1,300 - 2,700 cfs, depending on 4/1 runoff forecast.. May =1,650 - 2,700 cfs, depending on 5/1 runoff forecast.	Daily fluctuations in flows below Merwin powerhouse are restricted by flow plateaus. The target is no more than 12 flow changes during the plateau period and limited to one change in a 24-hour period. Up-ramping cannot exceed 1.0 foot per hour. In down-ramping, the rate of change depends on starting flow plateau. If $\geq$ 6,000 cfs, down-ramping cannot exceed 750 cfs per hour. Between 3,000-6,000 cfs, down-ramping $\leq$ 500 cfs per hour. Below 3,000 cfs, down-ramping $\leq$ 300 cfs per hour.
June 1 - July 31	June = 2,700 cfs if Merwin natural flow is $\geq$ 1,650 cfs. July 1-15 = 2,000 cfs, if Merwin natural flow is $\geq$ 1,200 cfs. July 16-31, 1,500 cfs if Merwin natural flow is $\geq$ 1,200 cfs.	Same as March 1 - May 31 period.
August 1- October 15	Constant minimum flow of 1,200 cfs	Same as December 8 - March 1
October 16 - December 7	October 16 - October 31, minimum flow of 2,700. November 1 - 15, 2,000 cfs plus the lesser of 4,200 cfs or natural flow at Merwin. November 16 - December 7, plus the lesser of 5,400 cfs or natural flow at Merwin.	Same as December 8 - March 1

Article 49 of the Merwin license regulates minimum flow and ramping rates of discharges from Merwin powerhouse (Table 1). These requirements were revised by FERC (FERC Order dated Sept. 13, 1995) and were agreed upon by Washington Department of Fisheries (WDF), Washington Department of Game (WDG), and PacifiCorp.

Yale. FERC No. 2071

The Yale Hydroelectric Project is a 134 MW plant located at approximately river mile (RM) 35. Construction of the Yale Project began in 1951 and was complete by 1953. Yale Dam has a crest length of 1,305 feet and a height of 323 feet above its lowest foundation point. A saddle dam 1/4 mile west of the main dam is approximately 1,600 feet long and 40 feet high. The crest elevation of both dams is 503 feet msl. The Yale project ranges in elevation from the tailrace at 239.6 msl (full pool in Lake Merwin) to full pool at elevation 490 feet msl. It can generate between full pool down to a minimum pool of 430 feet msl.

The reservoir formed by Yale Dam is approximately 10.5 miles long with a surface area of approximately 3,800 acres. At full pool, the reservoir has a gross storage capacity of approximately 401,000 acre-feet.

The Yale Hydroelectric Project also diverts water from Speelyai Creek into Yale Lake. Speelyai Creek is a small tributary to the North Fork Lewis River that flows southwesterly from its headwaters to Lake Merwin. The diversion, built in the late 1950s by PacifiCorp, is located approximately four miles upstream from the confluence with Lake Merwin. All of the water from upper Speelyai Creek is diverted through an ~ 0.7 mile canal into Yale Lake. Natural groundwater inflow to lower Speelyai Creek feeds the lower four miles. The WDFW utilizes the groundwater in lower Speelyai Creek for Speelyai hatchery water supply. At WDFW's request, water can be released from the diversion point into lower Speelyai Creek to supplement the hatchery water supply. PacifiCorp and WDFW each hold a 15 cfs water right for lower Speelyai Creek for the same purpose (i.e. to supplement Speelyai Hatchery water supply). PacifiCorp holds an additional water right for 70 cfs to be passed down the canal to Yale Lake for power purposes.

The Yale Project is operated in coordination with the other North Fork Lewis River projects to provide flood regulation in the basin; to accommodate recreation; and to schedule generation to match PacifiCorp's system requirements. Flood control at the Yale Project, and within the basin, is dictated by Article 43 of the Merwin license. The normal maximum and minimum Yale Lake elevations are 490 and 470 feet mean sea level (msl), respectively. During the summer months, PacifiCorp typically maintains a minimum pool of 485 feet msl for recreation purposes.

Swift No.1. FERC No. 2111

The Swift No.1 project at RM 40 is a 240 MW plant. Construction of the Swift No.1 project began in 1956 and was completed in 1958. Swift Dam has a crest length of 2,100 feet and a height of 512 feet above its lowest foundation point. It was the tallest earthen fill dam in the world when it was constructed. The Swift 1 project ranges in elevation from its tailrace at just over 600 feet msl to full pool at elevation 1000 feet msl. It can generate between full pool down to a minimum pool of 878 feet msl.

The reservoir formed by Swift Dam is approximately 11.5 miles long with a surface area of approximately 4,680 acres at elevation 1,000 feet msl (full pool). At maximum pool, the reservoir has a gross storage capacity of approximately 755,000 acre-feet.

The Swift No. 1 Project is operated in coordination with the other North Fork Lewis River projects to provide flood regulation in the basin, to accommodate recreation, and to schedule generation to match PacifiCorp's system requirements. Flood control at the Swift Project is also dictated by Article 43 of the Merwin license. The normal maximum and minimum Swift Reservoir elevations are 1,000 and 925 feet msl, respectively. During the summer months, PacifiCorp typically maintains a minimum pool of 995 feet msl for recreation purposes. The Swift No. 1 powerhouse discharges into the 3.2-mile-long Swift No. 2 Canal.

Swift No. 2. FERC No. 2213

The Swift No. 2 project is a 70 MW plant owned by Cowlitz PUD. PacifiCorp performs designated operation functions for the project under contract. Construction of the Swift No. 2 Project began in 1956 and was completed in 1958. The Swift No. 2 Canal begins in the tailrace of the Swift No. 1 powerhouse. A 3.2 mile power canal conveys all of the water from Swift No. 1 tailrace downstream to the Swift No. 2 powerhouse. Diversion of water from the Swift No.1 tailrace dewaters over 2 miles of the old river channel (Swift bypass). An ungated spillway and discharge channel (overflow spillway) prevents canal flows from exceeding the Swift No. 2 hydraulic capacity and maintains the maximum level in the canal.

Under normal operating conditions, the elevation of the canal waters at the Swift No. 2 intake ranges from 601 to 604 feet msl. The canal surface area is approximately 100 acres and the canal holds approximately 2,400 acre-feet of water. The capacity of the power canal is 11,000 cfs. PacifiCorp operates the powerhouse via remote control from the Hydro Control Center at Merwin headquarters in coordination with the other Lewis River hydroelectric facilities.

CONSERVATION MEASURES

Conservation measures represent actions incorporated in the project description by the action agency or applicant to minimize or compensate for effects of the projects on listed species. The following measures are proposed by the licensees as the designated non-federal representatives for FERC. FERC has included these measures as part of the proposed action in their BA. These measures will be implemented through amendments to the licenses.

Bull Trout and Cutthroat trout (Upstream from Merwin Dam)

Continue Yale Net and Haul

PacifiCorp proposes to continue net and haul activities in cooperation with WDFW as directed by the FWS (FWS letter dated Nov. 12, 1998).

Since the program began in 1995, an average of 21.5 percent of the bull trout spawning run were fish that benefitted from this net and haul. The program has also generated important information about the life history of the Yale Lake bull trout (See Table 2).

Table 2. Contribution of Merwin bull trout transported to Cougar Creek (from Lesko 2001)

YEAR	**Bull trout spawners observed in Cougar Creek**	**Number of bull trout transported (from Merwin to Cougar Creek mouth)**	**Number of bull trout spawners observed with Merwin tags [1]**			**Contribution of Merwin bull trout to Cougar Creek spawning escapement [2]**
			Yellow	**Pink**	**Green**	
1995	7	8	2			28 %
1996	11	14	1			9 %
1997	14	10	2	1		21 %
1998	7	6	2		2	57 %
1999	9	0				0 %
2000	7	7		1		14 %
Total	55	45	7	2	2	[3] Average Contribution - 21.5%

1. Adult bull trout were observed in Cougar Creek. Yellow tags were used in 1995, 1996 and 1998. Pink tags were used in 1997. Green tags were used in 1997 to denote bull trout captured at the Cougar Creek fish weir. Pink tags were used in 2000.
2. Estimate is based only on tags observed. Therefore, the contribution of bull trout transported in previous years is not known (assuming tag loss). Thus, estimate reflects only current (or recent) year transplants. As a result, the estimate is considered the lowest percent contribution possible.
3. Average annual contribution excluding 1999 when no fish were transported = 25.8 %

The FWS comment letter (November 12, 1998) on the Yale application for a new license recommended that PacifiCorp begin engineering studies concerning fish passage facilities at the projects. This concern is being addressed as part of the basin-wide fish passage studies through the ALP relicensing process. The ALP participants are currently developing a fish passage study to look at alternative passage measures.

Swift No.2 Net and Haul

PacifiCorp initiated a pilot net and haul program at Swift No. 2 tailrace in 1999. No bull trout were captured or observed at the tailrace but two were netted in the Swift Bypass reach directly upstream (PacifiCorp and Cowlitz PUD 2000b). Cowlitz PUD and PacifiCorp will continue a bull trout net and haul program at the Swift No. 2 tailrace if it is determined to be necessary by the FWS.

Entrainment Reduction

The involuntary entrapment of fish over a spillway or through the turbine intakes is called entrainment. Entrainment can cause injury or mortality and isolates fish from their upstream origin. There is evidence of entrainment through several points of egress at the Yale, Swift No. 1 and Swift No. 2 projects. A more detail discussion of entrainment follows under the effects of the action section.

In their draft BA, PacifiCorp and Cowlitz PUD proposed to evaluate the effectiveness of a strobe light system. However, after further review and discussion with the Services, this evaluation will be dropped at this time.

The FWS believes that the Yale and Swift No. l spillways have the potential to injure or kill fish including bull trout. PacifiCorp proposes to initiate an engineering study to address modification of the Yale spillway configuration in order to reduce the effects of this potential entrainment egress.

Habitat Protection for Yale Bull Trout

PacifiCorp has acquired lands from Weyerhaeuser Corporation in the Cougar/Panamaker Creek area, and proposes to place a conservation easement in the riparian corridor of this area to conserve and protect bull trout spawning and rearing habitat in perpetuity. The easement will include a 500-foot buffer along each side of Cougar Creek and a 200-foot buffer along each side of Panamaker Creek (See Figures 2 and 3). Such an easement will protect and conserve the habitat for bull trout, cutthroat trout and other aquatic species and will provide a high level of certainty that long-term benefits will accrue to these species.

PacifiCorp intends to maintain the property consistent with the conservation easement and biological opinion and incidental take statement. Maintenance that may be needed includes, but is not limited to, planting of vegetation, removal of non-native or invasive plant species, other vegetation management and installation of boundary markers or fences. Management of the lands outside the easement may include road and culvert maintenance in the short term and may eventually be included in the Lewis River wildlife management plan at the completion of ALP settlement discussions. PacifiCorp and Cowlitz PUD recognize and intend that the conservation easement along Cougar and Panamaker Creek riparian corridors are measures under the ESA for the benefit of the species in the entire range of all four projects.

Protect Swift Reservoir Bull Trout and Cutthroat Trout Habitat

Information is scarce on bull trout in the Swift Creek arm of Swift Reservoir and on the location and status of known sub-adult rearing habitat elsewhere in the reservoir. There is some evidence that sub-adult bull trout use the Swift Arm area for foraging. The level of use is unknown but bull trout sub-adults are frequently seen in this area. The adjacent riparian zone and uplands on the east side of Swift Arm are extremely steep and show evidence of road related land slides and natural instability.

PacifiCorp currently owns lands along the Swift Creek arm and proposes to create the Swift Creek conservation easement on those lands to protect and conserve habitat for bull trout, cutthroat trout, and other aquatic species in perpetuity. Cowlitz PUD has purchased lands adjacent to PacifiCorp's ownership along Swift Creek Arm known as the Devil's Backbone. Cowlitz PUD proposes to create the Devil's Backbone conservation easement on the lands immediately adjacent to PacifiCorp's Swift Creek conservation easement to protect and conserve habitat for bull trout, cutthroat trout, and other aquatic species in perpetuity. Both conservation easements will provide a high level of certainty that long-term benefits will accrue to these species by minimizing sedimentation due to human disturbance (See Figures 2 and 4).

PacifiCorp and Cowlitz PUD recognize and intend that the conservation easements along the Swift Reservoir shoreline and adjacent upland area on the Devil's Backbone are measures under the ESA for the benefit of the species in the entire range of all four projects. PacifiCorp and Cowlitz PUD shall coordinate with the Services and maintain the properties consistent with the conservation easements and biological opinion and incidental take statement. Such maintenance may include, but is not limited to, planting of vegetation, removal of nonnative or invasive plant species, other vegetation management and installation of boundary markers or fences.

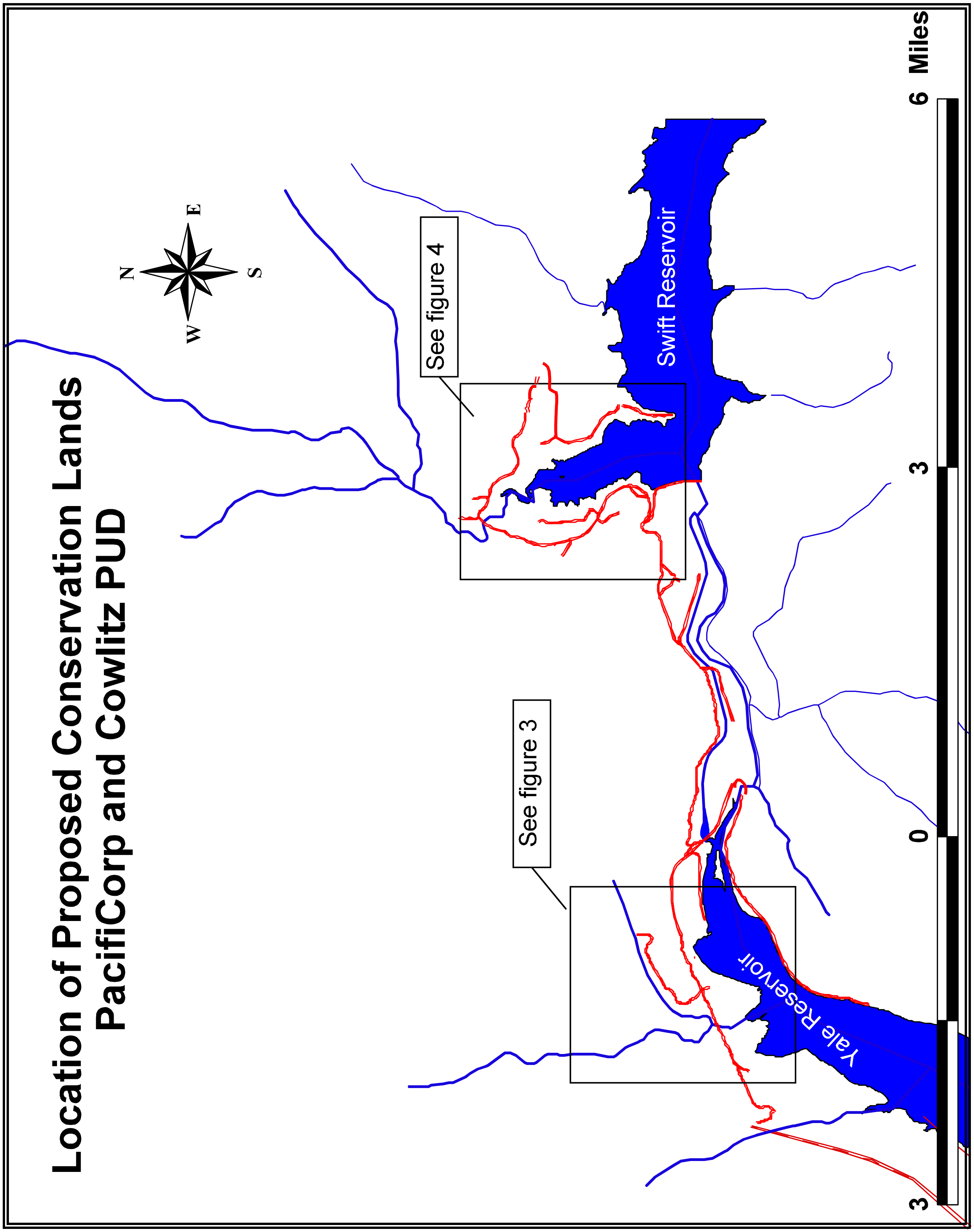

Figure 2 Conservation Easement Areas Map Sources: WDNR (Roads, Streams, and WRIA Basins)
WDFW (Lakes)

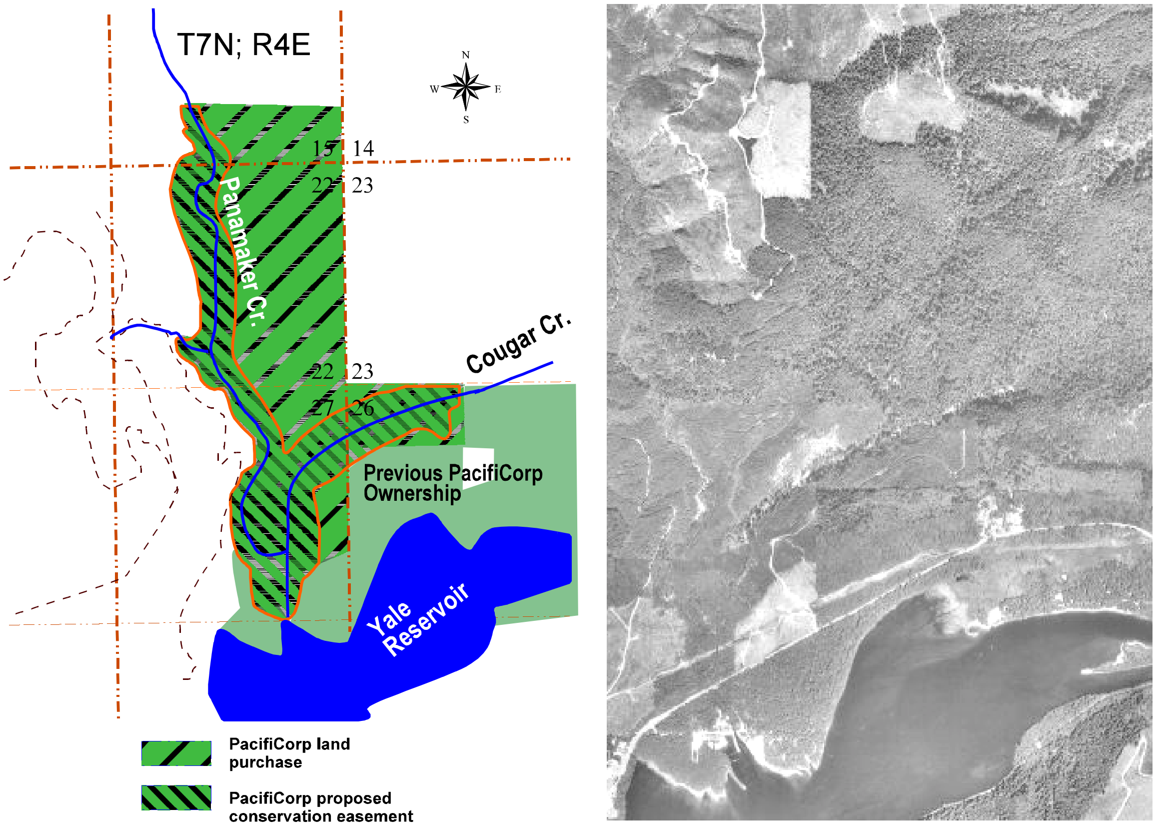

Figure 3 Cougar Creek Conservation Easement Area

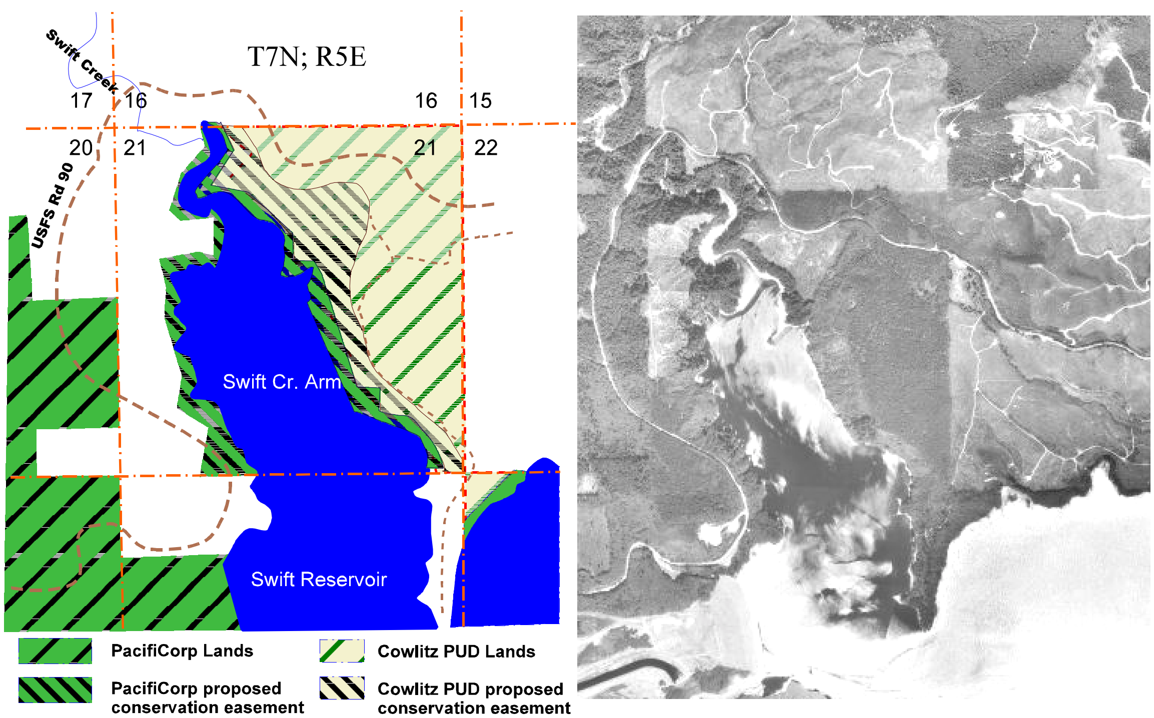

Figure 4 Swift Creek Arm Conservation Easement Area

Map Sources: WDNR (Roads, Streams) WDFW (Lakes) USFS (Ortho Photo)

Water Quality in Tailraces

Total dissolved gases (TDG) in water can become supersaturated (i.e. over 100%) when under pressure such as occurs in penstocks and below spillways. Serious injuries and mortality can result to fish that are present in water with supersaturated TDG. Bull trout have been found in the tailrace at Yale Dam, an area known to have had elevated TDG levels historically. Bull trout may also be present in the Swift No. 1 and Swift No. 2 tailraces where TDG levels are also known to exceed 100%.

PacifiCorp and Cowlitz PUD are completing studies evaluating TDG in the Swift No. 1 and Swift No. 2 tailraces. As a result of these studies the licensees may modify equipment to reduce TDG and temperature effects. Because of the historical elevated TDG levels in the Yale tailrace, PacifiCorp has implemented modifications to the Yale turbine intakes to reduce TDG levels.

Continue Population Monitoring

PacifiCorp and Cowlitz PUD propose to continue providing partial funding and in-kind services to maintain the Swift population monitoring database. PacifiCorp has been partially funding and participating in a WDFW/USFS cooperative Swift bull trout population monitoring project since 1988. Currently, WDFW is utilizing a visual mark-recapture protocol to estimate reservoir population size.

Habitat Enhancement and Protection for Anadromous Salmonids

Under proposed license amendments, FERC intended that PacifiCorp partnered with the Lower Columbia Fish Recovery Board and Clark County to protect the Eagle Island riparian zone. PacifiCorp, through an agreement with Clark County, provided[1] the county's portion of the funding to purchase the Eagle Island downstream of Merwin dam at about RM 12 (See Figure 5) and has deeded the property to the State. The final agreement protects the land in perpetuity. Eagle Island is the primary anadromous salmonid rearing site downstream of Merwin dam and is considered to be prime wild fall chinook juvenile rearing habitat. Development plans for Eagle Island had placed at risk at least 70 percent of the existing juvenile rearing habitat for wild chinook. The island's shallow shoreline margins and inlets are excellent rearing habitat for the North Fork's wild fall chinook. Hiding amid water plants along the island's six miles of shoreline, chinook and steelhead smolts can elude predatory birds and larger fish. As they grow, they move into the narrow channels on either side of the island, where they feed on drifting insects.

Providing Clark County's funding portion for purchase of the island allows the county to use their funds to protect and restore salmon and steelhead rearing areas through their Conservation Futures program to improve the habitat on the island for wildlife. While the Services have no connection to these efforts, we understand that WDFW plans to eradicate Scot's broom and plant willows along denuded sections of shoreline.

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[1] Land acquisitions were completed prior to the consultation being finished to allow confidentiality in purchasing the land.

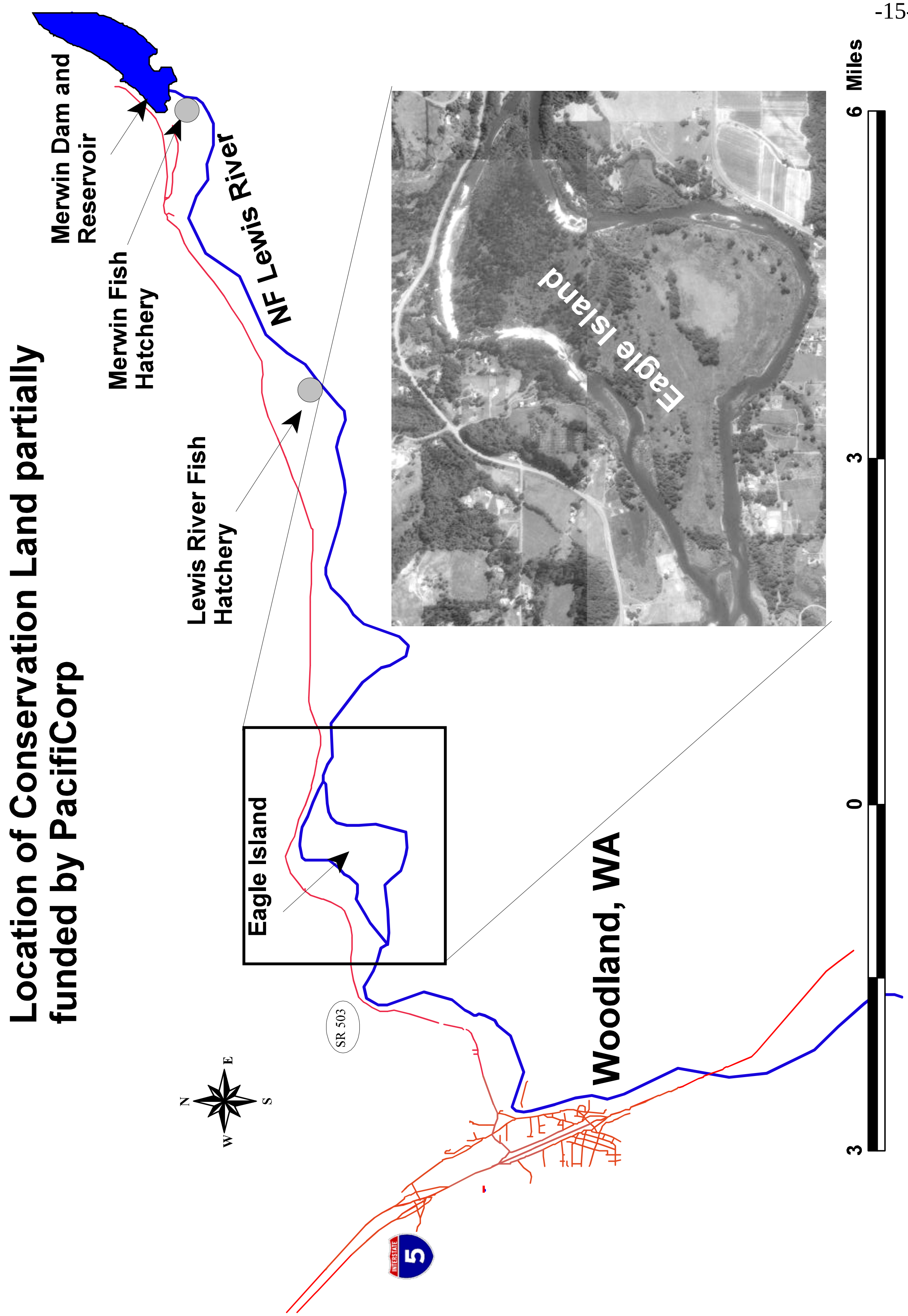

Figure 5 Map Sources: WDNR (Roads and Streams) USFS (Ortho Photo)

Ramping Rates Evaluation/Review/Modification

PacifiCorp proposes to modify the current Merwin downramping rates to meet a new standard of 0.5 feet per three-hour period (with the intent of no more than 2 inch/hour stage change) Up-ramping will be increased from 1 foot/hour to 1.5 feet/hour. This down-ramping rate protects juveniles and fry using shallow stream margin habitat. Up-ramping limitations focus on public safety for those using the river below the project. A Standard Operating Procedure (SOP) will be developed that describes how ramping requirements will be accomplished. The SOP will be subject to the Service's approval.

Related to potential for future unplanned shutdowns, PacifiCorp has finished mechanical upgrades to provide back-up power and additional alarms to prevent future losses of anadromous salmonid from mechanical failures. Past emergency shutdowns have de-watered the adult fish trap and downstream channels. It was estimated that the June 1999 shutdowns killed 101 adult salmonids in the trap and that the loss of juveniles was equivalent to 1500 adult fall chinook. A series of alarms and a video system to observe the tailrace area have been installed to aid the operator manage shutdowns. In addition, secondary and tertiary power back-up systems have been installed to allow automatic gate openings to maintain river flows.

Hatchery Evaluation

PacifiCorp proposes to assist WDFW with development of a HGMP to minimize hatchery effects on in-basin species. While the Services appreciate PacifiCorp's assistance in this work, the HGMP work, is being covered in another consultation.

Additional Studies

Numerous ongoing studies, summarized in Table 3 below, are designed to assess the complex impacts associated with the Lewis River projects. There is currently little information regarding some of the known or adverse effects related to the developments or the means to address some impacts; but during the interim period, evaluations addressing project effects are to be completed. FERC proposes to review the information generated by these studies to propose long-term solutions to continuing project impacts, such as the lack of upstream passage, which will be incorporated into new proposed license terms by 2006.

Table 3. Summary of study plans for the Lewis River relicensing.

Effect	Study Plan	Objectives	Work Products	Species	Due Date Est.
			Direct Effects		
Loss of habitat through lack of stream flow	Swift Bypass Reach Synthesis Study	Compile information on the current condition of the Swift bypass reach.	Water quality and temperature data in the bypass reach Pre-project and with-project quantity and timing of flows Synthesized flows (magnitude and timing) for the Rain/Ole Creek system Maps showing location and connectivity of wetlands and side channels Map showing existing vegetation cover types Aquatic and riparian habitat composition, structure and use aquatic species Maps of aquatic habitat types, substrate, spawning gravel area and LWD by habitat type Discuss potential and methods to provide controlled flows to the reach Weighted useable aquatic habitat area versus flows in the reach	Bull Trout	03/02
Periodic Elevated TDG	Total Dissolved Gas Study	Determine extent of TDG supersaturation at Swift No. 1 and No. 2 tailraces and establish relationship between TDG and discharge at Swift No. 1 and No. 2 tailraces. Determine the persistence of TDG in Swift canal and through Yale Lake.	Study Results Report	All	3/02
Flows and ramping rates	Merwin Streamflow and Ramping Rate Study	Identify flow effects on ESA listed species Determine if flows and ramping rate comply with Merwin license Identify stranding areas downstream of Merwin Dam and critical dewatering flows	Describe Merwin operations and potential stranding sites Show elevation and flow changes over time, overlaid with species periodicity Map of potential stranding areas and gage locations Elevation and flow changes over time at each potential stranding site Report on ramping rate/flow attenuation study Determine effects of Merwin flow regime on aquatic species Recommend Merwin streamflow Recommendations for operations at each potential stranding site	Anadromous salmonids	3/02
Lack of fish passage facilities	Engineering Feasibility Study for Fish Passage Facilities	Determine technical & biological feasibility of fish passage. Identify impacts on other resources. Develop planning-level cost estimates.	Fish Passage Feasibility Report	All	3/02
Resident fish entrainment	Evaluation of Fish Species Entrainment at Swift No. 1	Assess composition and abundance of fishes entrained through Swift No. 1 and present in tailrace and describe seasonal changes in species composition and abundance	Report on results	Bull trout	05/03
			Indirect Effects		
Loss of access to upstream anadromous fish habitat	Stream Channel Morphology & Aquatic Habitat Study (formerly the Sediment Budget and Large Woody Debris studies)	Document aquatic habitat values in stream reaches. Assess project effects on habitat & stream morphology. Assess effects of potential management changes.	Channel and reach maps Map indicating platform changes over time Gage stage graph Areas of spawning gravel graph Changes in grain size graph	All	Complete
	Assessment of Potential Anadromous Fish Habitat upstream of Merwin	Delineate/characterize existing lotic reaches above Merwin currently not accessible to anadromous fish.	Map and photos of fish barriers and barrier characteristics table Accessible areas table Stream segment gradient graph	Anadromous salmonids	Complete
Effects of project	Report on Life History, Habitat Requirements and Distribution of Aquatic Analysis Species	Document abundance and distribution and life history of aquatic analysis species.	Life History information Location and habitat GIS maps	All	Complete
Cumulative project effects	Cumulative Effects Study Plan	Prepare analysis for NEPA document	Cumulative effects analysis	All	2003

STATUS OF THE SPECIES (range wide and recovery unit)

Bull Trout

The FWS listed the Columbia River and Klamath Basin Distinct Population Segments (DPSs) of bull trout as threatened on June 10,1998 (USDI 1998a; 63 FR 31647). The Coastal/Puget Sound and St. Mary-Belly River DPSs of bull trout were listed as threatened on November 1, 1999 (USDI 1999; 64 FR 58910). This rule combined all DPSs of bull trout in the coterminous United States, and declared them all as threatened. These rules documented declining trends, associated habitat loss and fragmentation, and region wide and local extirpations of the species (Bond 1992; Thomas 1992; Rieman and McIntyre 1993; Donald and Alger 1993; Washington Department of Fish and Wildlife 1997).

Bull trout are one of four species of char native to western North America. The historic range of the bull trout spanned seven states (Alaska, Montana, Idaho, Washington, Oregon, Nevada, and California) and two Canadian Provinces (British Columbia and Alberta) along the Rocky Mountain and Cascade Mountain ranges (Cavender 1978). They have been recorded from the Jarbidge River in Nevada and the Klamath River basin in Oregon. In California, bull trout were historically found only in the McCloud River, which represented the southernmost extension of the species' range. Their range also includes Puget Sound, coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992).

Distribution has been reduced by an estimated 40 to 60 percent since pre-settlement times, due primarily to local extirpations, habitat degradation, and isolating factors. The remaining distribution is highly fragmented. Many populations and life history forms have been extirpated entirely. Highly migratory, fluvial populations have been eliminated from the largest, most productive river systems across their range. Stream habitat alterations restricting or eliminating bull trout include obstructions to migration, degradation of water quality (especially elevated temperatures and increased amounts of fine sediments), alteration of natural stream flow patterns, and structural modification of stream habitat (such as channelization or removal of cover).

The listing rule specifies that, in recognition of the scientific basis for the identification of bull trout DPSs (i.e., population segments are disjunct and geographically isolated from one another with no genetic interchange between them due to natural and man-made barriers), for the purposes of consultation and recovery planning these DPSs will serve as interim recovery units in the absence of an approved recovery plan. On that basis, the geographic scope of jeopardy analyses for actions under formal consultation will be at the DPS level instead of the entire range of this species.

<u>Life History</u>

Bull trout populations exhibit four distinct life history forms; resident, fluvial, adfluvial and anadromous. These different life history patterns may exist separately or in combination in the same tributary. It is also suspected that bull trout give rise to offspring exhibiting both resident and migratory behavior (Rieman and McIntyre 1993). Bull trout are generally not anadromous (Meehan and Bjornn 1991), although anadromy may have been important in the past (Bond 1992).

Resident bull trout complete their entire life cycle in the streams or nearby tributaries where they were hatched. These populations are generally found in small headwater streams where they spend their entire lives.

Fluvial bull trout spawn in tributary streams where the young rear from one to four years before migrating to a river where they grow to maturity. Adfluvial bull trout spawn in tributary streams, and after rearing migrate to a lake at ages 0+ to 4+ ((Riehle et al. 1997; Reiser et al. 1997; Fraley and Shepard 1989).

Currently, anadromous bull trout are only known to occur in Coastal-Puget Sound DPS sub-populations. Anadromous populations spawn in fresh water, and, after a period of juvenile rearing, migrate to saltwater, where they grow to maturity (Fraley and Shepard 1989; Goetz 1989). These diverse life histories are important to the stability and viability of bull trout populations (Rieman and McIntyre 1993).

The size and age of bull trout at maturity depends upon life-history strategy. Growth of resident fish is generally slower than migratory fish and they tend to be smaller at maturity and less fecund (Fraley and Shepard 1989; Goetz 1989). Growth is variable with different environments, but first spawning is often noted after age four, and the fish may live 10 or more years (McPhail and Murray 1979; Pratt 1992; Rieman and McIntyre 1993). Spawning occurs from August through December but adult bull trout may begin spawning migrations as early as April. They move upstream as far as 250 kilometers (km) to spawning grounds (Fraley and Shepard 1989). Hatching occurs in winter or early spring, and alevins may stay in the gravel for extended periods, sometimes exceeding 220 days.

Bull trout are opportunistic feeders with food habits primarily a function of fish size and life-history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro-zooplankton, and small fish (Boag 1987; Goetz 1989; Donald and Alger 1993). Adult migratory bull trout are primarily piscivores, known to feed on various fish species (Fraley and Shepard 1989; Donald and Alger 1993). In a 1979-1982 study, Graves (1983) found that the major food items for bull trout in Yale Lake were small fish up to 195 mm, primarily kokanee and cottids. The same study found that fish, crayfish, insects and occasionally small animals made up the bull trout diet in the Swift reservoir population.

Habitat requirements of the species

Bull trout have more specific habitat requirements than other salmonids (Rieman and McIntyre 1993). Growth, survival, and long-term population persistence appear to be dependent upon five habitat characteristics; temperature, cover, substrate, channel and hydrologic stability, and the presence of migration corridors (Thurow 1987). Because bull trout exhibit a patchy distribution even in pristine habitats (Rieman and McIntyre 1995), the fish should not be expected to simultaneously occupy all available habitats (Rieman et al. 1997).

1. Temperature

Cold water temperature is likely the most important habitat component for bull trout. Water temperature above 15 degrees Celsius (°C) is believed to limit bull trout distribution, which may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989; Rieman and McIntyre 1995).

Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992; Rieman and McIntyre 1993; Rieman et al. 1997; Shepard et al. 1984; Ratliff 1992; Fraley and Shepard 1989). Many studies show that temperatures must drop below 9 or 10°C before spawning occurs (McPhail and Murray 1979; Craig 1997; Fraley and Shepard 1989).

Successful spawning, development of embryos and juveniles and the distribution of juveniles require cold water temperatures (Goetz 1989; McPhail and Murray 1979; Pratt 1992; Fraley and Shepard 1989). Egg survival decreases as water temperature increases, with higher survival levels documented at 2 to 4°C (McPhail and Murray 1979). They reported that 0-20 percent of the bull trout eggs from British Columbia survived to hatching in water temperatures of 8-10°C. Conversely, 80-95 percent survived at 2-4°C.

Goetz (1994) did not find juvenile bull trout in water temperatures above 12°C. The best bull trout habitat in several Oregon streams, had temperatures that seldom exceed 15°C (Buckman et al. 1992; Ratliff 1992; Ziller 1992).

For migratory corridors, bull trout prefer water temperatures ranging between 10-12°C (McPhail and Murray 1979; Buchanan and Gregory 1997). However, bull trout will migrate in stream segments with higher water temperatures and are found in areas offering thermal refuge, such as confluences with cold tributaries (Swanberg 1997).

2. Cover

The distribution and abundance of bull trout is positively correlated with complex forms of cover including large woody debris, undercut banks, coarse substrates, and pools (Fraley and Shepard 1989; Goetz 1989; Sedell and Everest 1991; Pratt 1992; Thomas 1992; Sexauer and James 1997; Watson and Hillman 1997). Juvenile and adult bull trout frequently inhabit side channels, stream margins and pools with suitable cover (Sexauer and James 1997). Jakober (1995) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Bitterroot River drainage, Montana, and suggested that suitable winter habitat may be more restrictive than summer habitat. Deep pools also help minimize and moderate stream temperatures and offer refuge from warmer water temperatures during summer low-flow conditions. Studies conducted with closely related Dolly Varden showed that population density declined with the loss of woody debris after clearcutting or the removal of logging debris from streams (Bryant 1983; Dolloff 1986; Elliott 1986; Murphy et al. 1986). Keith et al. (1998) showed that the abundance of 1+ and older Dolly Varden was higher in pools with added instream cover than those without.

3. Substrate

Bull trout are more strongly tied to the stream bottom and substrate than other salmonids (Pratt 1992 Rieman and McIntyre 1993). Substrate composition has repeatedly been correlated with the occurrence and abundance of juvenile bull trout (Rieman and McIntyre 1993) and spawning site selection by adults (McPhail and Murray 1979). Preferred spawning habitat includes low gradient streams with loose, clean gravels (Fraley and Shepard 1989).

Fine sediments can influence incubation survival and emergence success (Weaver and White 1985), and may limit access to substrate interstices that are important cover during rearing and overwintering (Goetz 1994; Jakober 1995). Because bull trout eggs incubate about seven months in the gravel, they are especially vulnerable to fine sediments and water quality degradation (Fraley and Shepard 1989). Juveniles are similarly affected, as they also live on or within the streambed cobble (Oliver 1979; Pratt 1984). High juvenile densities were observed in Swan River, Montana, and tributaries with diverse cobble substrate and low percentage of fine sediments (Shepard et al. 1984). Garrett et al. (1998) found that pre-emergent survival of kokanee fry from redds in up-welling sites (84%) significantly exceeded that from redds in other areas (66%). However, they also found that kokanee salmon redds constructed in upwelling sites contained significantly more fine sediments ($\leq$ 0.83 mm) and were constructed in areas of significantly lower surface water velocities than redds not influenced by upwelling. Bull trout use a similar upwelling area with fine sediments at the head of Cougar Creek.

4. Channel and hydrologic stability

Due to the close connection to substrate, bed load movements and channel instability can reduce the survival of young bull trout. Maintaining bull trout habitat requires stream channel and flow stability (Rieman and McIntyre 1993). Bull trout are exceptionally sensitive to activities that directly or indirectly affect stream channel integrity. Juvenile and adult bull trout frequently inhabit areas of reduced water velocity, such as side channels, stream margins, and pools that are easily eliminated or degraded by management activities (Rieman and McIntyre 1993). Channel dewatering caused by low flows and bed aggradation has blocked access for spawning fish resulting in year class failures (Weaver 1992). Timber harvest and the associated roads may cause landslides that affect many miles of stream through aggradation of the streambed.

Patterns of stream flow and the frequency of extreme flow events that influence substrates may be important factors in population dynamics (Rieman and McIntyre 1993). With lengthy overwinter incubation and a close tie to the substrate, embryos and juveniles may be particularly vulnerable to flooding and channel scour associated with the rain-on-snow events common in some parts of the range (Rieman and McIntyre 1993). Surface/groundwater interaction zones, which are typically selected by bull trout for redd construction, are increasingly recognized as having high dissolved oxygen, constant cold water temperatures, and increased macro-invertebrate production.

5. Migration

Bull trout sub-population persistence requires more than maintaining fish in individual streams, it requires the ability to migrate (Rieman and McIntyre 1993; Gilpin1997; Rieman et al. 1997). Migratory bull trout ensure interchange of genetic material between populations, thereby ensuring genetic variability. Migratory corridors tie seasonal habitat together for anadromous, adfluvial, and fluvial forms, and allow for dispersal of resident forms for recolonization of recovering habitats (Rieman and McIntyre 1993). Individuals from different sub-populations interbreed when some stray and spawn in non-natal streams. Sub-populations that are extirpated by catastrophic events may also become reestablished in this manner. Migratory bull trout are more fecund and grow larger than non-native brook trout, which may reduce the likelihood of hybridization (Rieman and McIntyre 1993). Migratory corridors link seasonal habitats for all bull trout life-history forms. For example, in Montana, migratory bull trout make extensive migrations in the Flathead River system (Fraley and Shepard 1989) and resident bull trout move to overwinter in downstream pools in Bitterroot River tributaries (Jakober 1995).

Unfortunately, migratory bull trout have been restricted or eliminated due to stream habitat alterations, including seasonal or permanent obstructions, detrimental changes in water quality, increased temperatures, and the alteration of natural stream flow patterns. Dam and reservoir construction and operations have altered major portions of bull trout habitat throughout the Columbia River basin. Dams without fish passage create barriers to fluvial and adfluvial bull trout which isolates populations. The operations of dams and reservoirs alter the natural hydrograph, thereby affecting forage, water temperature, and water quality (USDI 1997).

Columbia River DPS

The action area for this consultation, the North Fork Lewis River, is located in the Columbia River DPS. The FWS recognizes 141 sub-populations of bull trout in the Columbia River DPS within Idaho, Montana, Oregon, and Washington with additional sub-populations in British Columbia. Of these sub-populations, approximately 79 percent are unlikely to be reestablished if extirpated and 50 percent are at risk of extirpation from naturally occurring events due to their depressed status (USDI 1998a). Many of the remaining bull trout occur as isolated sub-populations in headwater tributaries, or in tributaries where the migratory corridors have been lost or restricted. Few bull trout sub-populations are considered "strong" in terms of relative abundance and sub-population stability. Those few remaining strongholds are generally associated with large areas of contiguous habitats such as portions of the Snake River Basin in Central Idaho, the Upper Flathead Rivers in Montana, and the Blue Mountains in Washington and Oregon. The listing rule characterizes the Columbia River DPS as generally occurring as isolated sub-populations, without a migratory life form to maintain the biological cohesiveness of the sub-populations, and with trends in abundance declining or of unknown status.

Extensive habitat loss and fragmentation of sub-populations have been documented for bull trout in the Columbia River basin and elsewhere within its range (Rieman and McIntyre 1993). Reductions in the amount of riparian vegetation and road construction in the Columbia River basin due to timber harvest, grazing, and agricultural practices have contributed to habitat degradation through elevated stream temperatures, increased sedimentation, and channel embeddedness. Mining activities have compromised habitat conditions by discharging waste materials into streams and diverting and altering stream channels. Residential development has threatened water quality by introducing domestic sewage and altering riparian conditions. Dams of all sizes (i.e., mainstem hydropower and tributary irrigation diversions) have severely limited migration of bull trout in the Columbia River basin. Competition from non-native trout (USDI 1998a) is also considered a threat to bull trout.

Generally, where status is known and population data exist, bull trout populations in the Columbia River DPS are declining (Thomas 1992; Pratt and Huston 1993; Schill 1992). Bull trout in the Columbia River basin occupy about 45 percent of their estimated historic range (Quigley and Arbelbide 1997). Quigley and Arbelbide (1997) considered bull trout populations strong in only 13 percent of the occupied range in the interior Columbia River basin. Rieman et al. (1997) estimated that populations were strong in 6 to 24 percent of the subwatersheds in the entire Columbia River basin.

The FWS analyzed data on bull trout relative to sub-populations because fragmentation and barriers have isolated bull trout throughout their current range. A sub-population is considered a reproductively isolated group of bull trout that spawns within a particular area of a river system. Sub-populations were considered at risk of extirpation from naturally occurring events if they were: 1) unlikely to be reestablished by individuals from another sub-population; 2) limited to a single spawning area; and, either 3) characterized by low individual or spawner numbers; or 4) primarily of a single life-history form. In addition, the FWS considered a sub-population "strong" if 5,000 individuals or 500 spawners likely occur in the sub-population, abundance appears stable or increasing, and life-history forms were likely to persist; and "depressed" if less than 5,000 individuals or 500 spawners likely occur in the sub-population, abundance appears to be declining, or a life-history form historically present has been lost. If there was insufficient abundance, trend, and life-history information to classify the status of a sub-population as either "strong" or "depressed", the status was considered "unknown".

Lower Columbia River area

The Columbia River DPS is divided into four geographic areas of the Columbia River basin: 1) lower Columbia River (downstream of the Snake River confluence), 2) mid-Columbia River (Snake River confluence to Chief Joseph Dam), 3) upper Columbia River (upstream from Chief Joseph Dam), and 4) Snake River and its tributaries (including the Lost River drainage).

The lower Columbia River area includes all tributaries in Oregon and Washington downstream of the Snake River confluence near the town of Pasco, Washington. The FWS identified 20 sub-populations in watersheds of nine major tributaries of the lower Columbia River, including 2 in the Lewis River. The present distribution of bull trout in the lower Columbia River basin is much less than their historic range. They are thought to be extirpated from several tributaries in five river systems in Oregon (Buchanan et al. 1997).

Hydroelectric facilities and large expanses of unsuitable, fragmented habitat have isolated most sub-populations in the lower Columbia area. Large dams, such as McNary, John Day, The Dalles, and Bonneville, separate four reaches of the lower Columbia River. Although fish may pass each facility in both upstream and downstream directions, the extent to which bull trout use the Columbia River is unknown. In addition, the nine major tributaries have numerous dams, many of which do not provide upstream passage.

Migratory bull trout are present in at least 13 of the 20 sub-populations in the lower Columbia River. Many migratory fish are now adfluvial and inhabit reservoirs created by dams. However, the lower Columbia area contains the only extant adfluvial sub-population in Oregon, which exists in Odell Lake in the Deschutes River basin (Ratliff and Howell 1992; Buchanan et al.

1997). The Metolious River-Lake Billy Chinook sub-population, also found in the Deschutes River basin, is the only sub-population considered "strong" and exhibits an increasing trend in abundance. The FWS considers 5 of the 20 sub-populations at risk of extirpation from naturally occurring events due to isolation, single life-history form and spawning area, and low abundance.

Relationship of sub-populations to survival and recovery of bull trout in a DPS

Leary and Allendorf (1997) reported evidence of genetic divergence among bull trout sub-populations, indicating relatively little genetic exchange between them. Recolonization of habitat where isolated bull trout sub-populations have been lost is either unlikely to occur (Rieman and McIntyre 1993) or will only occur over extremely lengthy time periods. Remnant or regional populations without the connectivity to refound or support local populations have a greater likelihood of extinction (Rieman and McIntyre 1993, Rieman et al. 1997). In the Lewis River population, however, bull trout recolonized Pine Creek within a few years after it was severely altered by the Mount St. Helen's eruption (Faler and Bair 1996). While it is possible that these fish came from a remnant population in Pine Creek, it is much more likely that Rush Creek bull trout re-colonized the stream.

Healy and Prince (1995) reported that, because phenotypic diversity is a consequence of the genotype interacting with the habitat, the conservation of phenotypic diversity is achieved through conservation of the sub-population within its habitat. They further note that adaptive variation among salmonids has been observed to occur under relatively short time frames (e.g., changes in genetic composition of salmonids raised in hatcheries; rapid emergence of divergent phenotypes for salmonids introduced to new environments). Healy and Prince (1995) conclude that while the loss of a few sub-populations within an ecosystem might have only a small effect on overall genetic diversity, the effect on phenotypic diversity and, potentially, overall population viability could be substantial. This concept of preserving variation in phenotypic traits that is determined by both genetic and environmental (i.e., local habitat) factors has also been identified by Hard (1995) as an important component in maintaining intraspecific adaptability (i.e., phenotypic plasticity) and ecological diversity within a genotype. He argues that adaptive processes are not entirely encompassed by the interpretation of molecular genetic data; in other words, phenotypic and genetic variation in adaptive traits may exist without detectable variation at the molecular genetic level, particularly for neutral genetic markers. Therefore, the effective conservation of genetic diversity necessarily involves consideration of the conservation of biological units smaller than taxonomic species (or DPSs). Reflecting this theme, the maintenance of local sub-populations has been specifically emphasized as a mechanism for the conservation of bull trout (Rieman and McIntyre 1993).

Based on this information, the FWS concludes that each bull trout sub-population is an important phenotypic, genetic, and distributional component of its respective DPS. Therefore, adverse effects that compromise the functional integrity of a bull trout sub-population will be considered an appreciable reduction in the likelihood of survival and recovery of the DPS by reducing its distribution and potential ecological and genetic diversity.

Habitat Conservation Plans (Columbia River DPS)

The range-wide status of the bull trout has been affected by several recent Habitat Conservation Plans (HCPs) that were prepared in conjunction with incidental take permit applications to the FWS pursuant to section 10(a)(1)(B) of the ESA. The amendments to Plum Creek Timber Company (Plum Creek) and the Washington Department of Natural Resources (WDNR) HCPs specifically address bull trout.

The WDNR's HCP amendment (USDI 1998b) to include bull trout allowed for incidental take of bull trout associated with habitat degradation/loss due to 29 miles of road construction and maintenance per year and 158 acres of selective and thinning harvest per year. This amendment added only the Coastal/Puget Sound DPS of bull trout and that portion of the Columbia River

DPS west of the Cascade crest to the WDNR's HCP. Eastside Columbia Basin tributaries were not included.

The Plum Creek Timber Company's HCP amendment (USDI 1998c) added the Columbia River DPS of bull trout to their HCP. The amendment allowed for the take of bull trout associated with habitat degradation/loss due to 150 acres of selective and thinning/restoration-oriented silvicultural harvest per year, 2 miles of stream restoration per year, and 20.2 miles of road construction, maintenance, and removal per year. The term of the Plum Creek HCP and permit is 50 to 100 years.

Anadromous Salmonids

The Columbia River chum salmon were listed as a threatened species on March 25, 1999 (64 FR 14508). This ESU includes all naturally spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon.

NMFS listed the Lower Columbia River chinook salmon as a threatened species on March 24, 1999 (64 FR 14308). The ESU includes all naturally spawned populations of chinook salmon from the Columbia River and its tributaries from its mouth at the Pacific Ocean upstream to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River, and includes the Willamette River to Willamette Falls, Oregon, exclusive of spring-run chinook salmon in the Clackamas River.

Steelhead in the Lower Columbia River ESU, which includes naturally spawned populations and their progeny in the North Fork Lewis River below Merwin Dam, were listed as threatened by NMFS on March 19, 1998 (63 FR13347).

NMFS subsequently designated critical habitat for all three of these species on February 16, 2000 (65 FR 7764).

Chum Salmon

Columbia River ESU

The Columbia River historically contained large runs of chum salmon that supported a substantial commercial fishery in the first half of this century. These landings represented an annual harvest of more than 500,000 chum salmon as recently as 1942. Beginning in the mid-1950s, commercial catches declined drastically and in later years rarely exceeded 2,000 per year. Annual catch, as incidental take in the late fall mainstem Columbia River fishery, has been less than 50 fish since 1994.

The estimated minimum run size for the Columbia River ESU has been relatively stable, although at a very low level, since the run collapsed during the mid-1950s. Current abundance is probably less than 1% of historical levels, and the ESU has undoubtedly lost some (perhaps much) of its original genetic diversity. Average annual natural escapement to the index spawning areas was approximately 1,300 fish from 1990 through 1998 (ODFW and WDFW 1999). Index spawning areas are located in the Grays River system, near the mouth of the Columbia River, and in the Hardy Creek/Hamilton Creek/Ives Island complex below Bonneville Dam. WDFW surveyed other (non-index) areas in 1998 and found only small numbers of chum salmon (typically less than 10 fish per stream) in Elochoman, Abernathy, Germany, St. Cloud, and Tanner creeks and in the North Fork Lewis and the Washougal rivers.

The current upstream extent of spawning by Columbia River chum salmon, and thus the effect of Bonneville Dam as a barrier to migration, is unknown. Adult chum salmon are thought to show little persistence in surmounting river blockages and falls (63 FR 11775). The 10-year average

(1989 through 1998) count for the fish ladders at Bonneville Dam was 56 adults, although this statistic is heavily skewed by a count of 195 chum salmon in 1998 (J. Loch, WDFW, unpubl. data). The unusually high count was due to (1) an increase in the effort applied to reviewing the videotapes for observations of chum salmon and (2) unusually high activity in the fish ladders at night, possibly related to unusual temperature conditions in Bonneville pool (pers. comm., J. Loch, WDFW, January 28, 2000). Without the 1998 data, the 9-year average would be only 31 adult chum salmon. Hatchery fish have had little influence on the wild component of the CR chum salmon ESU. NMFS estimates a median population growth rate (lambda) over the base period,[2] for the ESU as a whole, of 1.04 (Tables B-2a and B-2b in McClure et al. 2000). Because census data are peak counts (and because the precision of those counts decreases markedly during the spawning season as water levels and turbidity rise), NMFS is unable to estimate the risk of absolute extinction for this ESU.

Life History

Chum salmon belong to the family Salmonidae and are one of eight species of Pacific salmonids in the genus Oncorhynchus. Chum salmon are semelparous (spawn only once then die), spawn primarily in fresh water, and apparently exhibit obligatory anadromy, as there are no recorded landlocked or naturalized freshwater populations (Randall et al. 1987). The species is best known for the enormous canine-like fangs and striking body color (a calico pattern, with the anterior two-thirds of the flank marked by a bold, jagged, reddish line and the posterior third by a jagged black line) of spawning males. Females are less flamboyantly colored and lack the extreme dentition of the males. The species has the widest natural geographic and spawning distribution of any Pacific salmonid, primarily because its range extends farther along the shores of the Arctic Ocean than that of the other salmonids (Groot and Margolis, 1991). Chum salmon have been documented to spawn from Korea and the Japanese island of Honshu, east, around the rim of the North Pacific Ocean, to Monterey Bay in southern California. The species' range in the Arctic Ocean extends from the Laptev Sea in Russia to the Mackenzie River in Canada (Bakkala 1970; Fredin et al.1977). Historically, chum salmon were distributed throughout the coastal regions of western Canada and the United States, as far south as Monterey, California. Presently, major spawning populations are found only as far south as Tillamook Bay on the northern Oregon coast. Chum salmon may historically have been the most abundant of all salmonids. Neave (1961) estimated that, prior to the 1940s, chum salmon contributed almost 50 percent of the total biomass of all salmonids in the Pacific Ocean. Chum salmon usually spawn in the lower reaches of rivers typically within 100 km of the ocean. Redds are usually dug in the mainstem or in side channels of rivers. In some areas (particularly in Alaska and northern Asia), they typically spawn where upwelled groundwater percolates through the redds (Bakkala 1970; Salo 1991). Chum salmon are believed to spawn primarily in the lower reaches of rivers because they usually show little persistence in surmounting river blockages and falls. However, in some systems, such as the Skagit River, Washington, chum salmon routinely migrate over long distances upstream (at least 170 km in the Skagit River) (Seattle City Light 1997). In two other rivers, the species swims a much greater distance. In the Yukon River, Alaska, and the Amur River, between China and Russia, chum salmon migrate more than 2,500-km inland. Although these distances are impressive, both rivers have low gradients and are without extensive falls or other blockages to migration.

In the Columbia River Basin, there are reports that chum salmon may historically have spawned in the Umatilla and Walla Walla Rivers, more than 500 km from the sea (Nehlsen et al. 1991). However, these fish would have had to pass Celilo Falls, a complex of rapids and cascades, which presumably were passable by chum salmon only at high water flows. During the spawning

[2] Estimates of median population grow th rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period from 1980 through 1998 adult returns for the Grays River mainstem and the West Fork, Crazy Johnson, and Hamilton Creek spawning aggregations and including the 1999 adult return s for Hard y Creek and Hamilton Springs. Population trends are projected under the assumption that all conditions will stay the same into the future.

migration, adult chum salmon enter natal river systems from June to March, depending on characteristics of the population or geographic location. Groups of fish entering a river system at particular times or seasons are often called “runs,” and run timing has long been used by the fishing community to distinguish anadromous populations of salmon, steelhead, and sea-run cutthroat trout. Run timing designations (e.g., summer versus fall or early-fall versus late-fall) are important in this status review because two of the ESA petitions for chum salmon (PRO-Salmon 1994; Trout Unlimited 1994) used run timing as evidence supporting population distinction. In Washington, a variety of seasonal runs are recognized, including summer, fall, and winter populations. Fall-run fish predominate, but summer runs are found in Hood Canal, the Strait of Juan de Fuca, and in southern Puget Sound (Washington Department of Fisheries (WDF) et al. 1993). Only two rivers have fish returning so late in the season that the fish are designated as winter-run fish, and both of these are in southern Puget Sound.

Depending on water temperature, hatching occurs from late December to late February. The newly hatched alevins, about 20.5-mm when hatched, remain in the gravel until conditions for seaward migration develop. In late February through May when they are about 30-35 mm long, they struggle up through the gravel and leave the redd. Where the spawning grounds are close to the sea, the fry move down the first night. Where the migration is longer, they hide in the gravel during the day and migrate at night. In some areas, the fry spend several weeks in fresh water. At times, the fry school before they reach the sea but they always form schools in the estuaries. The fish are as large as 70 mm at this time. They remain near shore for several months before they disperse into the sea and are usually gone from shore by late July or early August (Scott and Crossman 1979).

Habitat requirements of the species

1. Temperature

In North American streams, chum salmon generally choose areas for spawning with springs that provide water temperatures above 4°C (Salo 1991). This adaptation minimizes loss to incubating eggs because the outflow of groundwater compensates for freezing conditions. Schroeder et al. (1974) demonstrated higher mortality in salmonid eggs, alevins and fry that were incubated in temperatures less than 1.5°C.

2. Cover

Chum fry primarily emerge from gravels during the darkness and promptly emigrate from their natal stream (Salo 1991). Therefore, during periods of nocturnal migrations cover is not a significant factor for chum in the freshwater environment. As densities increase fry continue to move downstream.

3. Substrate

The presence of fines in chum spawning gravels has been shown to have a negative correlation with fry emergence and survival (Koski 1975). Dill and Northcote (1970) found that larger gravel size produced higher survival for chum from eggs to fry emergence.

4. Migration and Hydrologic Factors

Chum usually enter their natal spawning stream when they are ripe and in full spawning coloration (Fiscus 1969). Upstream migration is triggered by increases in stream runoff but, later in the fall season, flows have very little influence. Chum salmon prefer spawning in areas immediately upstream of turbulence (Salo 1991). Chum are strong swimmers and capable of migrating long distances in currents of moderate to high velocities (Salo 1991). In Washington, 80 percent of observed chum were found to spawn in velocities ranging from 21.3 to 83.8 cm/s in water depths of 13.4 to 49.7 cm (Johnson et al. 1971).

Chinook Salmon

Lower Columbia River ESU

The Lower Columbia River ESU includes all naturally spawned chinook populations from the mouth of the Columbia River to the crest of the Cascade Range, excluding populations above Willamette Falls. Celilo Falls, which corresponded to the edge of the drier Columbia Basin Ecosystem and historically may have presented a migrational barrier to chinook salmon at certain times of the year, is the eastern boundary for this ESU. Not included in this ESU are stream-type spring chinook salmon found in the Klickitat River, (which are considered part of the Mid-Columbia River spring-run ESU) or the introduced Carson spring-chinook salmon. Tule fall chinook salmon in the Wind and Little White Salmon Rivers are included in this ESU, but not introduced upriver bright fall chinook salmon populations in the Wind, White Salmon, and Klickitat Rivers.

In addition to the geographic features mentioned above, genetic and life-history data were important factors in defining this ESU. Populations in this ESU are considered ocean type. Some spring-run populations have a large proportion of yearling migrants, but this trend may be biased by yearling hatchery releases. Subyearling migrants were found to contribute to the escapement. Coded-wire-tagged recoveries for Lower Columbia River ESU populations indicate a northerly migration route, but with little contribution to the Alaskan fishery. Populations in this ESU also tend to mature at age 3 and 4, somewhat younger than populations from the coastal, upriver, and Willamette ESUs. Ecologically, the Lower Columbia River ESU crosses several ecoregions: Coastal, Willamette Valley, Cascades and East Cascades.

There are no reliable estimates of historical abundance for this ESU as early as the beginning of the last century, but it is generally agreed that natural production has been greatly reduced. Recent abundance estimates include a 5-year (1991 through 1995) geometric mean natural spawning escapement of 29,000 natural spawners and 37,000 hatchery spawners. However, according to the accounting of PFMC (1996), approximately 68% of the natural spawners are first-generation hatchery strays.

For the LCR chinook salmon ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[3] ranges from 0.98 to 0.88, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000). NMFS estimated the risk of absolute extinction for nine spawning aggregations,[4] using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years ranges from zero for the Sandy River late run and Big Creek to 1.00 for Mill Creek (Table B-5 in McClure et al. 2000). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years is $\geq$ 0.99 for all but one of the nine spawning aggregations (zero for the Sandy River late run; Table B-6 in McClure et al. 2000).

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[3] Estimates of median population growth rate, risk of extinction, and likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1997 adult returns for most spawning aggregations. Population trends are projected under the assumption that all conditions will stay the same into the future.

[4] McClure et al. (2000c) have calculated population trend parameters for additional LC R chinook salmon stocks.

Table 4. Estimated returns of adult LCR spring-run chinook salmon to tributaries, 1992 through
1999.

Year	Sandy River	Cowlitz River	Lewis River	Kalama River	Total Returns (Excluding Willamette)
1992	8,600	10,400	5,600	2,400	27,200
1993	6,400	9,500	6,600	3,000	25,500
1994	3,500	3,100	3,000	1,300	10,900
1995	2,500	2,200	3,700	700	9,100
1996	4,100	1,800	1,700	600	8,200
1997	5,200	1,900	2,200	600	9,900
1998	4,300	1,100	1,600	400	7,400
1999		1,600	1,900	600	

Source: Pettit 1998, ODFW and WDFW 1999

Life History

The LCR chinook salmon ESU includes spring stocks as well as fall tule and bright components. Spring-run chinook salmon on the lower Columbia River, like those from coastal stocks, enter freshwater in March and April, well in advance of spawning in August and September. Historically, the spring migration was synchronized with periods of high rainfall or snowmelt to provide access to upper reaches of most tributaries, where spring stocks would hold until spawning (Fulton 1968, Olsen et al. 1992, WDF et al. 1993).

Fall chinook salmon predominate in the lower Columbia River salmon runs. Tule-type fall chinook salmon return to the river in mid-August and spawn within a few weeks (WDF et al. 1993, Kostow 1995). Most fall-run chinook salmon emigrate to the marine environment as subyearlings (Reimers and Loeffel 1967, Howell et al. 1985, WDF et al. 1993). Returning adults that emigrated as yearling smolts may have originated from the extensive hatchery programs within the ESU. It is also possible that modifications in the river environment have altered the duration of freshwater residence. Adult fall-run tule chinook salmon return to tributaries in the lower Columbia River at 3 and 4 years of age compared to 4 to 5 years for bright chinook salmon and spring-run fish. Marine coded-wire-tag recoveries for LCR stocks tend to occur off the British Columbia and Washington coasts, although a small proportion of the tags are recovered in Alaskan waters.

Chinook salmon are easily distinguished from other *Oncorhynchus* species by their large size. Adults weighing over 120 pounds have been caught in North American waters. Chinook salmon are very similar to coho salmon in appearance while at sea (blue-green back with silver flanks), except for their large size, small black spots on both lobes of the tail, and black pigment along the base of the teeth. Chinook salmon are anadromous and semelparous. Adult female chinook will prepare a redd in a stream area with suitable gravel composition, water depth and velocity. Redds will vary widely in size and in location within the stream or river. The adult female chinook may deposit eggs in 4 to 5 nesting pockets within a single redd. After laying eggs in a redd, adult chinook will guard the redd from 4 to 25 days before dying. Chinook salmon eggs will hatch, depending upon water temperatures, between 90 to 150 days after deposition. Stream flow, gravel quality, and silt load all significantly influence the survival of developing chinook salmon eggs. Juvenile chinook may spend from 3 months to 2 years in freshwater after emergence and before migrating to estuarine areas as smolts, and then into the ocean to feed and mature.

Historically, chinook salmon ranged as far south as the Ventura River, California, and their northern extent reaches the Russian Far East. Among chinook salmon, two distinct races have evolved. One race, described as a "stream-type" chinook, is found most commonly in headwater streams. Stream-type chinook salmon have a longer freshwater residency, and perform extensive offshore migrations before returning to their natal streams in the spring or summer months. The second race is called the "ocean-type" chinook, which is commonly found in coastal streams in North America. Ocean-type chinook typically migrate to sea within the first three months of emergence, but they may spend up to a year in freshwater prior to emigration. They also spend their ocean life in coastal waters. Ocean-type chinook salmon return to their natal streams or rivers as spring, winter, fall, summer, and late-fall runs, but summer and fall runs predominate (Healey 1991). The difference between these life history types is also physical, with both genetic and morphological foundations.

Juvenile stream- and ocean-type chinook salmon have adapted to different ecological niches. Ocean-type chinook salmon tend to utilize estuaries and coastal areas more extensively for juvenile rearing. The brackish water areas in estuaries also moderate physiological stress during parr-smolt transition. The development of the ocean-type life history strategy may have been a response to the limited carrying capacity of smaller stream systems and glacially scoured, unproductive, watersheds, or a means of avoiding the impact of seasonal floods in the lower portion of many watersheds (Miller and Brannon 1982).

Coastwide, chinook salmon remain at sea for 1 to 6 years (more commonly 2 to 4 years), with the exception of a small proportion of yearling males (called jack salmon) which mature in freshwater or return after 2 or 3 months in salt water (Rutter 1904; Gilbert 1912; Rich 1920; Mullan et al. 1992). Ocean- and stream-type chinook salmon are recovered differentially in coastal and mid-ocean fisheries, indicating divergent migratory routes (Healey 1983 and 1991). Ocean-type chinook salmon tend to migrate along the coast, while stream-type chinook salmon are found far from the coast in the central North Pacific (Healey 1983 and 1991; Myers et al. 1984). Differences in the ocean distribution of specific stocks may be indicative of resource partitioning and may be important to the success of the species as a whole. There is a significant genetic influence to the freshwater component of the returning adult migratory process.

Habitat requirements of the species

1. Temperature

As with other salmonids, water temperature influences the physiology, behavior, and mortality of juvenile chinook salmon. The upper lethal temperature for chinook fry is 25.1˚C (77.2˚F); the preferred temperature is 12 to 14˚C (53.6 to 57.2˚F) (Scott and Crossman 1973).

Alderice and Velsen (1978) found that when incubation temperature varied with ambient temperature, development and survival was better when the incubation temperature was at a constant low. At around 3°C, chinook eggs hatch in about 159 days (Healey 1991). Downstream migration of chinook does not appear to be correlated with water temperature or flow (Mains and Smith 1964; Healey 1980).

2. Cover

Lister and Genoe (1970) found that chinook fry inhabited river margins, particularly back-eddies, behind fallen trees, undercut tree roots or other forms of bank cover. As the fish increased in size, they moved to more mid-stream positions with higher velocities. Chinook that overwinter (yearlings) tended to move out of tributary streams and into mainstem river habitat where they occupied deep pools and crevices between boulder and rubble (Riemers and Loeffel 1967).

3. Substrate

Adequate spawning area and subgravel flow are also very important in the choice of redd sites. Spawning spring chinook require about 16 m^2 (172 ft^2) of gravel per spawning pair. Ocean-type chinook require about 24 m^2 (258 ft^2) of gravel (Burner 1951). Chinook fry use the entire range of substrates found in the Lewis River; most fry were found in a narrow band within 4.6 m (15 ft) from shore (NESC 1984). Burner (1951) observed that chinook generally chose coarser gravel than other salmonids and chinook redds were generally characterized as having a few large cobble-size stones in the bottom. Gravel sizes used range from 1.3 to 10.2 cm (0.5 to 4.0 in) in diameter (Bovee 1978).

4. Migration and Hydrologic Factors

Freshwater entry and spawning timing are believed to be related to local temperature and water flow regimes (Miller and Brannon 1982). Seasonal runs (i.e., spring, summer, fall, or winter) have been identified on the basis of when adult chinook salmon enter freshwater to begin their spawning migration.

Adult chinook salmon will spawn in tributaries as small as 2 m (6.5 ft) wide and in the mainstem of larger rivers (e.g., the Columbia, Cowlitz, and Lewis rivers). Generally, spring chinook prefer to spawn in middle and upper reaches of the mainstem areas, while fall chinook prefer the middle and lower mainstem areas (WDFW 1994). Chinook will spawn in water depths ranging from 5 cm to 720 cm (0.2 to 23.6 ft) and in velocities ranging from 10 to 189 cm/s (0.3 to 6.2 ft/s) (Healey 1991, Bovee 1978). Spawning depths are generally greater than 24 cm (9.4 in); preferred velocities range from 30 to 91 cm/s (1.0 to 3.0 ft/sec) (Bovee 1978, Bell 1986, Bjornn and Reiser 1991). Kjelson, et al. (1981) observed that peak downstream migration of smolts in the spring occurred during and after peak storm events. Stein et al. (1972) speculated that other factors such as interactions with other species may also contribute to migration initiation.

Steelhead

Lower Columbia River ESU

Historically, steelhead likely inhabited most coastal streams in Washington, Oregon, and California as well as many inland streams in these states and Idaho. However, during this century, over 23 indigenous, naturally reproducing stocks of steelhead are believed to have been extirpated, and many more are thought to be in decline in numerous coastal and inland streams in Washington, Oregon, Idaho, and California. Forty-three stocks have been identified by Nehlsen et al. (1991) as being at moderate or high risk of extinction. The ESU includes all naturally spawned populations of steelhead (and their progeny) in streams and tributaries to the Columbia River between the Cowlitz and Wind Rivers, Washington (inclusive) and the Willamette and Hood Rivers, Oregon (inclusive). Excluded are steelhead in the upper Willamette River Basin above Willamette Falls and steelhead from the Little and Big White Salmon Rivers in Washington.

The lower Columbia River ESU includes all naturally spawned populations of steelhead in the Columbia River and its tributaries from its estuary up to, and including, the Hood River in Oregon. Critical habitat is designated to include all river reaches accessible to listed steelhead in Columbia River tributaries between the Cowlitz and Wind rivers in Washington and the Willamette and Hood rivers in Oregon, inclusive. Also included are adjacent riparian zones, river reaches, and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to the Hood River in Oregon. Excluded are tribal lands and areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). In addition, NMFS included the adjacent riparian area along the designated stream reaches as part of the critical habitat. NMFS defines this as the "area adjacent to a stream that provides the following functions: shade, sediment, nutrient or chemical regulation, streambank stability, and input of large woody debris or organic matter." Impacts on riparian critical habitat would be assessed site-specifically based on the potential effects of land use activities on the riparian functions listed above.

For the LCR steelhead ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[5] ranges from 0.98 to 0.78, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000). NMFS has also estimated the risk of absolute extinction for seven of the spawning aggregations, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years ranges from zero for the Kalama River summer run and the Clackamas River and Kalama River winter runs to 1.00 for the Clackamas River summer run and the Toutle River winter run (Table B-5 in McClure et al. 2000). Assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years rises to 1.00 for all but one population (the risk of extinction is 0.86 for the Green River winter run; Table B-6 in McClure et al. 2000).

Life History

Steelhead exhibit one of the most complex suites of life history traits of any salmonid species. Steelhead may exhibit anadromy (meaning that they migrate as juveniles from fresh water to the ocean, and then return to spawn in fresh water) or freshwater residency (meaning that they reside their entire life in fresh water). Resident forms are usually referred to as "rainbow" or "redband" trout, while anadromous life forms are termed "steelhead." Few detailed studies have been conducted regarding the relationship between resident and anadromous steelhead and consequently, the relationship between these two life forms is poorly understood. Recently however, the scientific name for the biological species that includes both steelhead and rainbow trout was changed from *Salmo gairdneri* to *O. mykiss*. This change reflects the premise that all trout from western North America share a common lineage with Pacific salmon.

Fry emerge from the gravel after yolk sac absorption. Juveniles typically rear for 1 to 3 years before migrating out of the basin. The majority of wild steelhead migrating from the Columbia tributaries are age 2. Peak steelhead smolt migration occurs from May to mid-June. Steelhead then reside in marine waters for typically 2 or 3 years prior to returning to their natal stream to spawn as 4- or 5-year-olds. Unlike Pacific salmon, steelhead are iteroparous, meaning that they are capable of spawning more than once before they die. However, it is rare for steelhead to spawn more than twice before dying; most that do so are females.

Habitat requirements of the species

1. Temperature

the optimum spawning temperature for steelhead is about 7˚C (45˚F), but they have been reported spawning at temperatures of 3.8˚ to 12.6˚C (39 to 55˚F) (Bell 1986, Barnhart 1991). The preferred water temperature for rearing steelhead ranges from 10 to 13˚C (50 to 55˚F) (Bjornn and Reiser 1991).

[5] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period that varies between spawning aggregations. Population trends are projected under the assumption that all conditions will stay the same into the future.

2. Cover

Most steelhead in their first year of life live in riffles, but some larger fish also inhabit pools or deep fast runs (Barnhart 1991). Instream cover such as large rocks, logs, root wads, and aquatic vegetation are very important for juvenile steelhead. This cover provides resting areas, visual isolation from competing salmonids, food, and protection from predators. Often steelhead densities are highest in streams with abundant instream cover.

3. Substrate

Steelhead spawn in mainstem and tributary streams and use a wide range of substrate sizes from fine gravel to medium gravel.

4. Migration and Hydrologic Factors

Great life history variability is found among steelhead populations. Steelhead populations can be broadly divided into summer-run and winter-run fish, depending on when the spawning migration enters the fresh water. Lewis River spring-summer runs enter fresh water typically from May through November and move upstream to hold over until the following spring to spawn (NMFS 1996b). Adult winter-run steelhead normally enter rivers from November to May and are near final stages of maturity upon entry.

Available information for natural populations of steelhead reveals considerable overlap in migration and spawn timing between populations of the same run type. Moreover, there is a high degree of overlap in spawn timing between populations regardless of run type, with populations beginning spawning in March.

Steelhead use riffles and also deep pools with relatively high velocities along the center of the channel (Bisson et al 1988). Rearing juveniles use both tributary and mainstem habitat. Moderate to high gradient habitat (0.5-5.0% slope) is generally the most productive for raising steelhead (Gibbons et al. 1985). With many exceptions, summer-run steelhead spawn in the upper or headwater parts of river basins or in river sections accessible during the high flows of early summer (Behnke 1992).

ENVIRONMENTAL BASELINE

Regulations implementing the ESA (50 CFR §402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have undergone section 7 consultation, and the impacts of State and private actions which are contemporaneous with the consultation in progress. Such actions include, but are not limited to, other hydroelectric projects, timber harvest, water diversions, and other land-management activities.

For purposes of this consultation, the Services have determined the action area to be the North Fork Lewis River. The North Fork Lewis River reviewed in this consultation is included in the Lower Columbia River Geographical Area of the Columbia River DPS for bull trout (USDI 1998a). It contains the Yale Lake and Swift Reservoir bull trout sub-populations. For anadromous fish, the action area is included in the Lower Columbia River ESUs for chinook salmon and steelhead and the Columbia River ESU for chum salmon.

The North Fork Lewis River basin lies on the flanks of the southern Cascade Mountains of Washington State. The river generally flows southwest from its source on the slopes of Mount Adams to the Columbia River 19 miles downstream of Vancouver, Washington. The river is 93 miles long and has a total fall of 7,900 feet, the greater part of which is in the upper reaches. At its mouth and up to the Lewis River Hatchery, the river stage is influenced by tides and subsequent backflow from the Columbia River. The area of the drainage basin is 1,050 square miles; its mean elevation is 2,550 feet mean sea level (msl). Slopes in the upper portions of the basin are generally steep, resulting from the incision of numerous streams and rivers into the geologically young landscape. Most of the tributaries have natural barrier falls or are too precipitous for spawning (Chambers 1957; Kray 1957). Areas to the south of the Merwin Project and downstream along the river are less steep, represented by rolling hills and flat woodland bottomlands.

The climate in the North Fork Lewis River basin is influenced by the Pacific Ocean to the west and the Cascade Range to the east. The Pacific Ocean provides a moderating influence on temperatures in the basin. Storms from the Pacific encounter the Cascade Range, forcing the air masses to rise, cool, and drop large volumes of precipitation. Levels of precipitation increase with elevation in this area. Average annual precipitation varies from 45 inches near Woodland, to over 140 inches on Mount Adams. The majority of the precipitation occurs during the rainy fall and winter months, with snow falling at higher elevations of the basin. July through mid-October are generally drier.

The majority of the North Fork Lewis River basin is forested, a condition typical of the Southern Washington Cascades. However, an area of approximately 30 square miles within the upper basin was denuded by the May 18, 1980 eruption of Mount St. Helens.

A large portion of the North Fork Lewis River basin is managed as commercial forest, and as such is undeveloped except for logging roads. In recent years, these lands have experienced increased recreation use and demand for residential development. Other land uses include farming in the lower elevation areas, hydropower, parks, and the Mount St. Helens National Volcanic Monument (Monument). The small communities of Cougar, Chelatchie, and Amboy lie in the upper basin, along with scattered private homes and recreational properties. The largest town near the projects is Woodland, Washington, approximately 10 miles downstream of the projects.

Basin lands provide winter range for deer and elk. Mink and beaver are common in wetlands. Large numbers of amphibians have been observed in the basin, primarily in wetland and riparian/riverine habitats. Over 100 species of birds have also been observed, including waterfowl, raptors, and numerous species of passerines. The Lewis River downstream of the project contains populations of unlisted coho salmon (*Oncorhynchus kisutch*), cutthroat trout (*O. clarki clarki*), white sturgeon (*Acipenser transmontanus*) and many other aquatic species.

Bull Trout

It is not known how the present hydroelectric reservoirs have affected the North Fork Lewis River bull trout population because of the uncertainty as to what bull trout life histories existed before construction of the hydro projects. Two theories are possible: 1) that the population of bull trout in the North Fork Lewis River were fluvial, with adults residing in the Columbia River and migrating into the North Fork Lewis River to spawn; and, 2) the population was fluvial and completed its life cycle entirely in the North Fork Lewis River and its tributaries. There is some archeological evidence indicating the possible existence of anadromous bull trout in the lower Columbia River and some of its tributaries. The WDG (1973) and WDFW (1998) believe that anadromous and fluvial bull trout/Dolly Varden utilized the Lewis River downstream of Merwin Dam before the dams were constructed.

Whichever life history strategy theory is correct, the effect of conversion of the population to an adfluvial strategy is unknown. The reservoirs may be providing a greater prey base than the original riverine habitat although the prey are not the same. Regardless, it is evident that habitat for spawning and rearing is limited. If the original population was a fluvial type that utilized North Fork Lewis River tributaries for spawning and rearing, the availability of habitat has not changed appreciably since that time. An exception may be Ole and Rain Creeks via the original North Fork Lewis River channel. Historically, Ole and Rain creeks may have provided some habitat for bull trout, but presently both creeks are intermittent at their mouths during the bull trout spawning migration season. Currently, Rain Creek is in an extremely aggraded condition. Whether this is a natural condition or is caused by logging and road building in the upper watershed is not clear.

The two sub-populations of bull trout in the Lewis River are both within the North Fork, with one sub-population in Yale Lake and one in Swift Reservoir (USDI 1998a). As of 1997, only migratory (adfluvial) bull trout had been identified in these reservoirs (WDFW 1998). No known spawning sites are accessible to bull trout in tributaries to Merwin Reservoir or the North Fork Lewis River. Therefore, bull trout found in Lake Merwin are probably there due to spill and are not considered a sub-population.

Two Lewis River sub-populations were verified by recent genetic analysis (Spruell et al. (1998). This analysis indicated that North Fork Lewis River bull trout are similar to the Columbia DPS , but that Yale and Swift Reservoir bull trout sub-populations differ significantly. They suggest that some genetic separation could have occurred between the two groups before construction of the dams and that it is unlikely that the 35 years of separation created by the dams could have resulted in genetic drift to this extent. They also suggest that if population sizes are approaching extinction, transfer of individuals between reservoirs may be appropriate. The FWS does not believe that the two Lewis sub-populations are at risk of extinction in the near term. But if conditions change or trends indicate a declining population, then this will need to be re-evaluated.

Merwin, Yale and Swift dams segment the North Fork Lewis River and do not allow upstream passage. The occurrence of limited downstream passage by bull trout over these dams or through the turbines is assumed based on observed adult bull trout in Merwin Reservoir and subadults in the Swift No. 2 power canal. Bull trout currently occupy 22.1 km (11.9 mi) of the mainstem North Fork Lewis River including identified spawning tributaries in Pine, Rush and Cougar Creeks (USFS 1995). Although Platts et al. (1995) concluded that insufficient information existed to determine the status and trends of bull trout in Swift and Yale reservoirs, WDFW (1998) considers the sub-populations to be depressed due to "chronically low abundance." The status summary for the Klamath and Columbia DPS lists both the Swift and Yale sub-populations as depressed (USFWS 1998).

The primary limiting factor for Yale and Swift bull trout production seems to be the availability of adequate spawning and rearing habitat. The only known bull trout spawning of the Yale sub-population occurs in Cougar Creek. The fact that only one and three-quarter miles of spawning and rearing habitat in Cougar Creek exists for the Yale population may explain the chronically low numbers of spawning adults observed each fall since records have been kept. With the exception of possible rearing habitat in Ole and Rain creeks, there are limited opportunities for expanding or improving habitat for the Yale bull trout population. Graves observed bull trout spawning in the Swift bypass reach in 1979, 1981, and 1982 (Graves 1979 Graves 1983). However, the potential for permanent spawning areas in this reach is not without risk. The bypass reach serves as a spill channel and has passed flows as high as 44,700 cfs in the 1996 flood. Flows of this magnitude scour the channel of much of the spawning gravels and could eliminate bull trout redds.

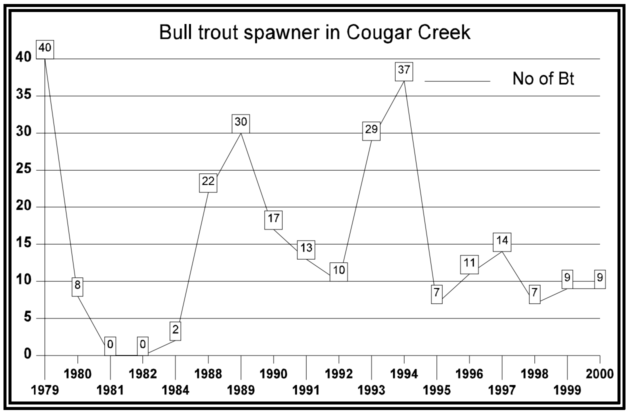

Figure 6 Recent Bull Trout Spawning Estimates in Cougar Creek

Spawning ground surveys conducted since 1988 in Cougar Creek are so variable it is impossible to establish a trend. (See Figure 6) The status of the Yale Lake sub-population is considered to be depressed with an unknown trend (USDI 1998a).

Spawning bull trout were observed in the Swift bypass reach in 1979, 1981 and 1982 (Graves 1979; Graves 1983). It is assumed that these fish spawning in the bypass reach were part of the Yale Lake population although it is possible that these fish may have been Swift reservoir fish that were isolated in Yale due to entrainment during spill or through the turbines of Swift 1 and Swift 2. Juvenile fish were found in the Siouxon and Cougar Creek inlets (Graves 1983). The size of these fish ranged upward from 0+ fish at 152mm. Historical creel census data collected in Yale (Figure 7) show a steady decline in the number of bull trout caught (Graves 1983). This decline may be an indication that the actual population was declining even as far back as 1978.

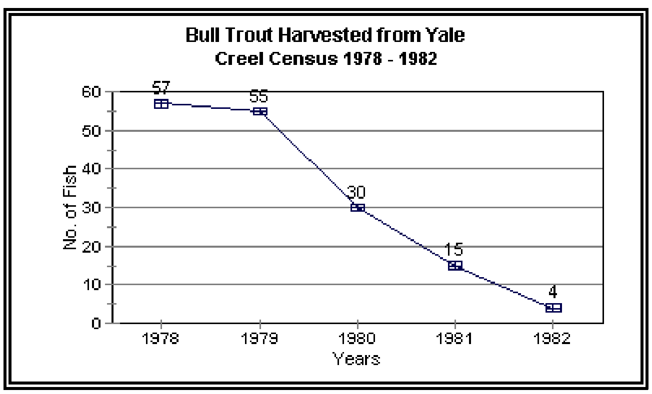

Figure 7 Historical Creel Census of Bull Trout Harvest in Yale Lake

The Swift Reservoir sub-population spawns in Pine and Rush creeks (WDFW 1998). Radiotelemetry studies conducted on bull trout in Swift Reservoir indicate that migrating adults use both Rush and Pine creeks with no evidence of reproductive isolation. Bull trout distribution is limited to the lower 1.6 km (1.0 mi) of Rush Creek due to an impassable falls, and the expansion of bull trout range within other tributaries in the upper watershed may be limited by unsuitable temperature regimes (Faler and Bair 1996).

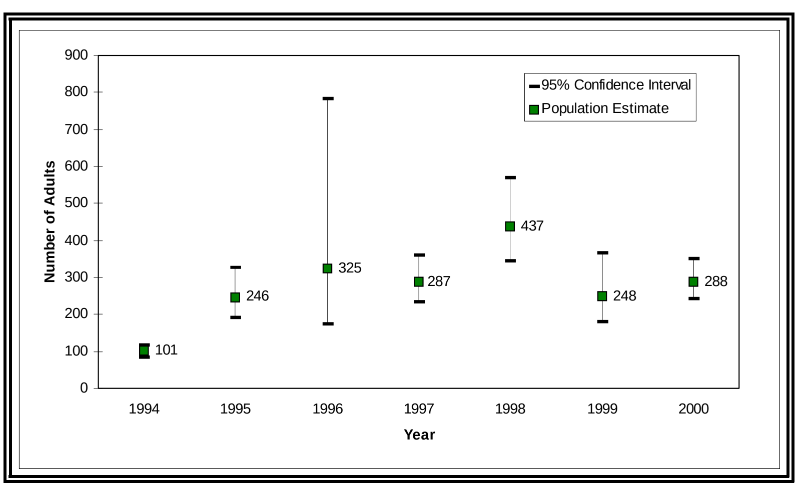

Figure 8 Recent Bull Trout Population Estimates in Swift Reservoir

Recent spawning surveys on Pine and Rush Creeks show a possible upward trend in population size, but the variability of the data makes this determination difficult (See Figure 8).

Unlike the Yale Lake sub-population, bull trout in Swift Reservoir have a larger spawning area and connectivity between spawning grounds (Pine and Rush creeks), which may buffer this sub-population against stochastic events. For example, after the 1980 eruption of Mt. St. Helens when habitat throughout the Pine Creek drainage was severely altered (Faler and Bair 1996), migratory bull trout from Swift Reservoir subsequently recolonized Pine Creek. The status of the Swift Reservoir sub-population is considered to be depressed with a stable trend (USDI 1998a).

Bull trout in the Lewis River were most recently affected by the April 21, 2002, breach that occurred in the Swift power canal supplying the Swift No. 2 powerhouse near Cougar, Washington. This resulted in the discharge of approximately 17,000 gallons of transformer oil and other debris into Yale Lake. The breach released an estimated 2,200 acre feet of water (about 800 million gallons) and several thousand cubic yards of rock, sediment and other fill material. This debris and oil contaminated sediment were mostly contained within upper Yale Lake in a large sediment plume below the canal breach.

The rapid discharge of the canal water, stranded several bull trout, resulting in at least 6 dead bull trout that were collected by USFWS and WDFW personnel. Several isolated pools of water remained in the canal of which several near the lower end dried up rapidly. Salvage efforts, as of May 14, 2002, resulted in the recovery of 10 live bull trout. These fish were successfully transported above Swift No. 1 dam. Two large isolated pools remained as of the above date and recovery efforts were continuing.

The oil that was released into Yale reservoir from the transformers was a light oil with low toxicity to aquatic species. Monitoring of the reservoir surface did not discover any dead fish that may have come from the breach. However, it is likely that several bull trout were transported out of the canal and into Yale reservoir during the discharge. These fish are now isolated from their spawning population.

The Cowlitz PUD plans on re-building the project but in the interim, water from Swift No. 1 flows through the upper one-third of the power canal and is then shunted into the bypass reach. The effects of this are similar to project operations before the breach except that any bull trout in the power canal would not be subject to entrainment at the Swift No. 2 project. These bull trout may stay in the remaining portion of the power canal or they may move through the shunt into the upper end of Yale Lake.

Anadromous Salmonids

Number and Distribution of each species

Chum Salmon

Little is known about the life history of Lower Columbia River chum salmon in the North Fork Lewis River. Smoker et al. (1951) confirmed the presence of chum in the North Fork Lewis River downstream of Merwin dam. Chambers (1957) reported 96 chum spawning just downstream of Merwin dam in mid-November of 1955. Chum were sighted occasionally during 1998 fall chinook spawning surveys and 4 adult carcasses were observed in Cedar Creek. A total of 22 redds were seen during November 2000 surveys, most in the reach between Cedar Creek ramp and Merwin Dam (pers. comm. Nancy Usitalo, WDFW, April 23, 2001). In addition, about 45 juvenile chum were captured during seining operations related to a smolt residual study in 1998. (pers. comm. S. Hawkins-WDFW). Annually, about 3 or 4 adult chum have also been captured at the Merwin fish trap (pers. comm. R. Nicolay, WDFW).

Chinook Salmon

Three chinook salmon stocks are found in the Lewis River, but only two are listed as threatened species. The spring chinook stock in the North Fork Lewis River is thought to be primarily returns from Carson stock released from the North Fork Lewis River Hatchery (pers. comm. R. Nicolay B WDFW). In the North Fork Lewis River, spring chinook have been supplemented with Cowlitz and Carson hatchery stocks since 1956 and current returns are thought to be solely hatchery origin (pers. comm. R. Nicolay, WDFW 1999). It is a component of the Lower

Columbia chinook ESU, but is not considered a listed species (Table 2 of 64 FR 14308). North Fork Lewis River bright fall chinook are wild and a designated index stock used for monitoring purposes under the Pacific Salmon Treaty. The bright fall chinook run is considered a wild run although the run has experienced intermittent supplementation from 1940 through 1986 (pers. comm. R**.** Nicolay, WDFW 1999). Both the Lewis River bright and Lewis River tule fall chinook runs are components of the Lower Columbia River Chinook ESU, which is listed as a threatened species. The Tule fall chinook run has also been supplemented with Kalama stock since 1940. Both fall chinook stocks are currently self-sustaining.

Fall chinook currently utilize the lower 4 to 7 miles of spawning and rearing habitat downstream of Merwin dam. Historically, McIsaac (1990) states that construction of Merwin Dam eliminated approximately half the fall chinook spawning habitat which would place the upper limits of fall chinook migration to approximately Yale dam. Spring chinook have been documented as far upstream as the Muddy River (Washington State 1928).

Steelhead

North Fork Lewis River Steelhead

The North Fork Lewis River supports populations of winter and summer steelhead, both of which are part of the Lower Columbia River steelhead ESU, which is listed as threatened. The number of adults returning to the upper river and run-timing for each of these species is determined by trapping adult migrants in the fish ladder at the North Fork Lewis River hatchery and the fish trap at Merwin Dam. In addition, WDFW conducts spawning surveys on the East Fork Lewis River and Cedar Creek. The primary spawning areas for North Fork Lewis River steelhead are located downstream of Merwin dam in Cedar Creek and Johnson Creek, and the East Fork Lewis River. Rearing occurs in those same tributaries and the mainstem North Fork Lewis River between Merwin dam and Eagle Island. Rearing and spawning habitat is limiting in the tributaries given the size of Cedar and Johnson creeks and the presence of upstream migration impediments. WDFW continues spawning surveys on Cedar Creek and has installed a trap at the Grist Mill fish ladder to monitor upstream migration and to segregate hatchery and wild stocks. There are no existing data on the average annual size of the natural outmigration.

Today, North Fork Lewis River winter steelhead are thought to be native, although some interbreeding has probably occurred with introduced stocks from Elochoman, Chambers Creek, Cowlitz, and Skamania hatcheries that have been planted in the basin since the late 1940s (NPPC 1990). The summer steelhead stock in the Lewis River is also considered native, although interbreeding with introduced Skamania hatchery stock has likely occurred (NPPC 1990). In addition, steelhead which abandoned the Cowlitz system following the eruption of Mount St. Helens in 1980 probably strayed into the Lewis River and spawned with native Lewis stock (WDFW 1994).

From 1979-80 through 1994-95, annual angler catch of summer steelhead in the mainstem and North Fork Lewis River has averaged 2,932 fish. Catch of winter steelhead during this same period has averaged 1,508 fish (PacifiCorp 1999). Prior to 1994, all steelhead captured at the Lewis River Hatchery were returned to the river for angler harvest. Therefore, hatchery returns are not an accurate indicator of total run size.

Currently, there is very little wild steelhead production in the North Fork Lewis River below Merwin Dam; wild steelhead returns account for approximately 7 percent of the total North Fork run size (WDFW 1994). Due to the low return of wild summer steelhead in the North Fork, no escapement goal has been established (PacifiCorp and Cowlitz PUD 2000c). The escapement goal for wild winter steelhead on the North Fork is 698 fish.

From 1946 to present, approximately 40,000 to 100,000 winter and summer steelhead hatchery smolts have been released annually in the North Fork Lewis River basin. The majority of hatchery smolts migrate the year of release. Wild summer steelhead probably migrate mainly as freshwater age-2 and age-3 smolts, and return mainly as 2-salt adults. Hatchery smolts typically return as 2-salt adults. The WDG/WDFW has stocked the North Fork Lewis River with Beaver Creek winter steelhead stock and Skamania summer steelhead stock since 1946 (WDF and FWS 1951).

There is no legal harvest for wild steelhead in the North Fork Lewis River basin; all wild steelhead caught must be released unharmed. Hatchery fish are adipose fin clipped for easy identification. Hillson and Tipping (1999) estimated 523 summer steelhead were caught between August 15 and October 31, 1998.

NMFS subsequently designated critical habitat for all three of these species on February 16, 2000, (65 FR 7764).

Biological Requirements of Anadromous Fish Under the Environmental Baseline

'Migration and hydrologic factors,'as discussed in the Status of the Species section, *supra*, is the primary habitat requirement that is affected under the environmental baseline. Access to a significant portion of historical spawning and rearing habitat has been blocked for LCR chinook and LCR steelhead by construction of the four Lewis River dams. Past emergency shutdowns have dewatered the channel downstream of Merwin Dam, resulting in mortality of juvenile LCR chinook. Ramping rates under the existing license may strand juveniles and fry that rear in shallow stream margin habitat. In addition, the reduction of peak flushing flows due to impoundments and blockage of sediment and large wood behind the Lewis River dams may affect downstream channel morphology and the habitat requirements of substrate and cover. Overall availability of spawning and rearing habitat for all three anadromous species downstream of Merwin Dam has been reduced by other land use activities, such as commercial timber harvesting and increased residential development. Continued loss of good spawning and rearing habitat is likely given that current trends of development and resource use are likely to continue. The recent purchase of Eagle Island is likely to largely offset this trend in loss of good spawning and rearing habitat below the project. This action does not result in a change in current baseline conditions because it preserves already-existing spawning and rearing habitat. However, it is important because it prevents additional loss of rearing habitat due to timber harvesting and development. The effect of this action is to improve the future survival (both throughout the period covered by this opinion and in future years) of CR chum, LCR chinook, and LCR steelhead by avoiding additional losses of this crucial habitat.

Based on the information above, not all of the habitat and biological requirements of CR chum salmon, LCR chinook salmon, and LCR steelhead in the action area are being met under the environmental baseline. The status of these species is such that there must be a significant improvement in the habitat and biological conditions they experience, over those currently available under the environmental baseline, to meet their biological requirements for survival and recovery.

EFFECTS OF PROJECT OPERATIONS AND THE PROPOSED LICENSE AMENDMENT

The "effects of the action" is defined in the ESA section 7 implementing regulations as:

> "the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline. Indirect effects are those that occur later in time but that are reasonably likely to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration." (50 CFR §402.02).

FERC's proposed action includes operation of the projects as defined under existing FERC licenses, certain modified operations under the August 16, 2000, proposed license amendments, and conservation measures that are in addition to license requirements that have been committed to by Applicants.

A number of the license amendments and conservation measures directly or indirectly affect project operations. For example, ramping rate changes, measures to address entrainment, and trap and haul measures may all have effects on and be affected by project operations. Thus, ongoing project operations are considered as part of the effect of the action.

The Consultation Handbook (USFWS and NMFS 1998) provides the following direction for determining the effects of FERC relicensing actions and of other ongoing water projects (i.e., those existing before the ESA-listing of the species considered in a section 7 consultation):

> "When analyzing these water projects, as well as water contract renewals for Bureau of Reclamation (Bureau) programs and ongoing discretionary operations of Bureau and Corps of Engineers water facilities, use the same approach as for other types of Section 7 analyses.
>
> - The total effects of all past activities, <u>including effects of the past operation of the project</u> (emphasis added), current non-Federal activities, and Federal projects with completed Section 7 consultations, form the environmental baseline;
>
> - To this baseline, future direct and indirect impacts of the operation over the new license or contract period, including effects of any interrelated and interdependent activities, and any reasonably certain future non-Federal activities (cumulative effects), are added to determine the total effect on listed species and their habitat."

Therefore, the effects of the action encompass the effects of the continued operation of the Lewis River projects under the proposed action. The effects of the original construction and past operation of the Lewis River projects are part of the environmental baseline; e.g., blocked fish passage caused by the construction and operation of Merwin Dam up to the present time is part of the environmental baseline. However, blocked fish passage resulting from the continued presence and operation of the dam into the future is considered an effect of the action.

Furthermore, even after all the proposed operational improvements are implemented, the continued operation of the dam may still result in adverse effects to listed fish. The operational improvements will diminish the level of adverse effects caused by the continued operation of the Lewis River projects. Additional studies will further analyze the effects of the projects and assess measures to address such effects. To the extent that additional studies identify measures to further mitigate project impacts, such mitigation will be included in the BO for the new license and implemented during the term of that license.

DIRECT EFFECTS

As previously described, there are three dams and four hydroelectric projects on the North Fork Lewis River. Each project has varying degrees of effect on the listed, proposed and candidate trout and salmon species, depending on its location in the basin. NMFS (1996) has determined that the threatened salmonids in the Lewis River are listed partially due to the present or threatened destruction, modification, or curtailment of their habitat or range. Biological requirements are best expressed in terms of environmental factors that define properly functioning freshwater aquatic habitat necessary for the survival and recovery of LCR chinook, chum and steelhead. These environmental factors include fresh-water habitat access, habitat-forming watershed processes, riparian and channel condition elements, hydrologic functions, and water quality.

Within the action area, these habitat elements are necessary for pre-spawning survival and distribution, spawning success, egg-to-smolt survival, smolt emigration survival and timing, and smolt condition to allow the long-term survival of the species. Properly functioning watersheds, where all of the individual factors operate together to provide healthy aquatic ecosystems, are necessary for the survival and recovery of these species. Therefore, potential adverse project effects on anadromous fish result from a lack of fish passage, inadequate instream flows/ramping rates and spill.

In addition, adequate population levels must safeguard the genetic diversity of the listed stocks, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment.

There are numerous direct adverse project effects on listed and proposed non-anadromous bull trout and cutthroat resulting from inter-reservoir fish passage, entrainment, power operations (including instream flows), spill, and water quality. Indirect effects of the project on both anadromous and resident fish are discussed later in the document.

UPSTREAM FISH PASSAGE

Lake Merwin and Dam

The continued existence of the Lewis River dams under the proposed action blocks access to historical spawning and rearing areas for LCR chinook and LCR steelhead, affecting the 'migration and hydrologic factors' habitat requirement. This effect is identical to that which has occurred under the environmental baseline. Upstream migration of chum salmon is not affected by the presence of the Lewis River dams.

When the Merwin Hydroelectric Project was put into service in 1931, access for anadromous salmonids to the North Fork Lewis River above the dam was blocked. Accessible spawning and rearing habitat areas were reduced to present day levels. The presence of Merwin Dam, therefore, has a direct adverse effect on salmonid reproduction by limiting access to historical spawning and rearing habitat. Upstream projects add to this ongoing impact by continuing to occupy historical habitat. At the present time, NMFS recognizes Merwin Dam as the upstream extent of critical habitat for chinook and chum salmon, and steelhead (65 FR 7764, February 16, 2000).

Because fish passage with conventional ladder design was considered impractical (Pacific Fisherman 1930), a fish trap was constructed to facilitate movement of all adult anadromous fish upstream of Merwin Dam. During the period between construction of the Merwin Dam in 1932 and the Yale Dam in the early 1950's, the Washington Department of Fisheries (WDF) attempted to maintain the run by collecting adults for hatchery propagation or release to the spawning grounds. As native runs dwindled, Cowlitz spring-run chinook salmon were reintroduced in an effort to maintain them. The Washington Department of Fisheries (WDF), through funding and cooperation from Pacific Power and Light, established and continued a trap and haul operation until 1956 (Chambers 1957). Simultaneously, a hatchery program was established to assist in maintaining the runs (Chambers 1957). These hatchery fish were derived from the original Lewis River stocks. Only chinook, coho and steelhead capture was documented in the trapping log. By 1957, only fall chinook and coho were entering the Merwin trap. Smoker et al. (1951) attributed the decline in salmon and steelhead runs to reservoir predators, turbines, and intermittent spill (i.e., the lack of consistent spill as a means of downstream smolt passage). Excess hatchery fish were fairly consistently released above Merwin dam into Lake Merwin to provide fishing opportunities until the 4(d) rule was published.

Currently the only remaining self-sustaining anadromous fish population is the wild fall chinook. LCR bright fall chinook salmon escapement to the North Fork Lewis River exceeded the escapement goal of 5,700 by a substantial margin every year from the 1970s until 1998. However, runs have been declining and probably combined with the effect of the 1996 and 1997 floods on habitat, the 1999 return was low (about 3,400). An ocean escapement of 18,400 is forecast for 2001 (PFMC 2001). During the past 25 years an average of 7.2% of the estimated run size entered the Merwin trap. Most wild fall chinook use the spawning grounds in the North Fork Lewis River below Merwin Dam. This is not surprising considering that they are mainstem spawners, the quality and stability of the spawning gravels (Stillwater 1998) and the fact that fall chinook did not historically utilize the upper watershed upstream of the current Yale Dam (McIsaac 1990; WDF and FWS 1951).

This pattern of decline is also evident in other Southwest Washington Spring chinook salmon runs. Spring chinook salmon returning to the Cowlitz, Kalama, and Lewis rivers have declined in recent years, but they still number several hundred to a few thousand in each system (NMFS 2000). Similar patterns are being exhibited with the Southwest Washington component of LCR steelhead. The Kalama River population is the only one in Washington State considered healthy (WDFW 1997b). All other winter steelhead populations (i.e., those in the Cowlitz, Coweeman, North Fork and South Fork Toutle, Green, North Fork Lewis, and Washougal River are considered depressed, and the Wind River stock is classified as critical (WDFW 1997b).

The trapping facility at Merwin Dam allows for collection and transport of adult salmon and steelhead to hatchery holding ponds. This is currently the only potential means of upstream passage above Merwin Dam. The WDFW uses the Merwin trap as a management tool to separate wild from hatchery fish and to recycle fish by transporting excess hatchery fish to the lower river. This allows selected fish to pass through the recreational fishery downstream of Merwin Dam another time. Wild fish are immediately returned to the tailrace. Since all but the fall chinook are hatchery stocks, separation and recycling can benefit wild chinook by removing hatchery spawners from the wild population.

Chambers (1957) surveyed the remaining spawning areas available in the North Fork Lewis River basin prior to Swift Dam. He estimated there was considerable mainstem North Fork Lewis River spawning habitat between Swift Creek and Bolt Camp (Rush Creek) and found favorable spawning conditions on Muddy River, and Cougar, Clear, Clearwater and Smith creeks. The remaining creeks either had precipitous falls near their mouths or were considered too steep to provide useable spawning habitat. Muddy River, which was severely impacted by the Mount St. Helens eruption, has high turbidity, which was not indicated by Chambers in his 1957 report (PacifiCorp and Cowlitz PUD 2000b). High turbidity levels may affect fish migration. If turbidity or temperature barriers exist in the Muddy River, the upstream tributaries of Clear, Smith and Clearwater Creeks would not be accessible.

The impact of the continued lack of access to historical spawning and rearing areas above Merwin Dam on the ability of the LCR chinook and LCR steelhead ESUs to survive and recover is difficult to assess at this time. A Technical Recovery Team (TRT) is currently evaluating the population structure of each of these ESUs, which should place the significance of the Lewis River runs in the context of the entire ESU. The TRT is also describing the criteria for establishing viability of each ESU and its constituent populations. The TRT is expected to complete its tasks within 1-2 years and, once this information is available, it should be easier to determine if access to habitat above Merwin Dam is necessary for the recovery of LCR chinook and LCR steelhead. It is unlikely that the continuing lack of access during the short interim period considered in this biological opinion will result in extinction or preclude future recovery of any of the Lewis River runs, based on current abundances and the fact that passage has been blocked since 1931 without resulting in extinction of the runs.

Correspondingly, the ALP considers fish passage to be a major issue for evaluation during FERC relicensing. PacifiCorp has completed an assessment of potential anadromous fish habitat upstream of Merwin and is working on studies covering the technical and biological feasibility of upstream and downstream passage. These studies are due to be completed in March 2002. In this same time frame, planning-level cost estimates and other impacts related to passage are being examined (Table 4).

Yale Lake and Dam

Yale Dam is a migration barrier to bull trout and other resident fish inhabiting Merwin Reservoir. No known spawning areas exist in tributaries to Merwin Reservoir so it is assumed that the adult bull trout observed in the Yale tailrace are attempting to migrate upstream. It is believed that bull trout in the Yale tailrace originated in Yale/Cougar Creek.

Bull trout have a very high fidelity to spawning area (Rieman and McIntyre 1993) and movement of the Yale tailrace fish upstream to Cougar Creek or other identified areas in Yale may assist in the recovery of the bull trout in Yale Lake. Before the net and haul program began in 1995, it is likely that the same or even greater numbers of adult bull trout were prevented from spawning. An average of 8 adult bull trout annually have been transported around Yale dam since 1995 (see Table 2). During this same period of time the spawning escapement into Cougar Creek ranged from 7 to 14 with an average of 9 adult fish. Not all of the transported fish spawned the year of transport, but an average of 21.5 percent of each year's spawning population was hauled from below Yale dam. The net and haul program could potentially result in injury to fish but no fish have been noticeably injured since the program began.

Given the low numbers of observed spawners in Cougar Creek, lack of passage at Yale Dam is a significant effect. The FWS has identified upstream bull trout passage as an issue at the North Fork Lewis River projects, particularly Yale.

Swift No. 1 Dam and Reservoir

Swift No. 1 Dam prevents upstream migration of bull trout and other resident fish. The adverse biological effects of a lack of upstream passage at Swift Dam is not clear and the options will be fully explored during relicensing (See entrainment discussion below). This issue is also being addressed by the Lower Columbia River Bull Trout Recovery Team (Recovery Team). The Recovery Team is currently developing a recovery plan that includes the Lewis River for incorporation into the larger scale Columbia River DPS Recovery Plan.

The lack of upstream passage is a significant effect on the Lewis River bull trout sub-populations. Adult bull trout in Lake Merwin are blocked from their spawning area in Cougar Creek. Human intervention has reduced this isolation, but there is no assurance that all of the adult bull trout are being netted and transported. Because Yale bull trout are prevented from migrating upstream this precludes any possible genetic interchange with Swift bull trout. The Swift sub-population is also affected by the lack of upstream passage facility over the Swift Dam. Any Swift fish that are spilled or otherwise emigrate into Yale are isolated from their natal spawning streams. These Swift fish may provide some possible genetic interchange if they choose to spawn in Cougar Creek with Yale bull trout.

ENTRAINMENT

The involuntary entrapment of fish over a spillway or through the turbines intakes is called entrainment. Spill is when water is released through the spillway due to either flood events or other planned releases. Entrainment by either egress can case injury or mortality and isolates fish from their upstream origin.

Spill at the Lewis River projects is recurrent but variable depending on the water year and conditions. Yale Dam spills more often than the other two projects. Swift Dam spills only on rare occasions and at extremely high flow conditions. Graves (1983) reported that Yale Dam spilled 24 consecutive days in the winter of 1977-78, 1 day in May 1980, 15 days in the winter of 1980-81, 4 days in June 1981 and 14 days in winter 1981-82. In contrast, 1995 and 1996 were extremely wet years and resulted in frequent spills at all three dams.

Graves (1983) investigated entrainment on a cursory level at all three projects and indicated that several thousand kokanee were found in the Merwin trap and downstream of Merwin Dam in 1981 following six days of spilling. No bull trout or cutthroat trout were observed. No listed anadromous fish are currently trapped and passed upstream of Merwin Dam, so entrainment does not affect LCR chinook salmon, LCR steelhead, or CR chum salmon at any of the Lewis River projects. Entrainment related to resident fish and correlated with passage of anadromous fish will be addressed further in relicensing efforts. Any evaluation of future passage options should take downstream entrainment and mortality into consideration.

Merwin

There is no information on the effects of entrainment at Merwin Dam on bull trout, but inferences can be drawn from historic studies of salmon passage. Schoeneman et al. (1954) estimated coho mortality to be 46% ($\pm$ 7 %) through the Ariel (Merwin) spillway. Spill entrainment at Merwin was evaluated by Hamilton et al. (1970) but no determination on survival or effects were made. In Baker Lake, Hamilton and Andrew (1954) found coho mortality through the spillway ranged from about 49 - 65% depending on the operations of the gates. Sockeye mortality during spill was much higher, ranging from 62 - 82%. Turbine mortality was 34% for sockeye and 28% for coho which is much lower than the spillway. Comparisons of spill mortalities between the Lewis projects and Baker Lake should be viewed cautiously because the configurations of the two projects differ significantly. Neither Schoeneman et al. (1954) or Hamilton et al. (1970) reported bull trout entrainment, but since the study focused on salmon, trout including bull trout, may have been ignored.

The Merwin turbine intakes are located near the bottom of the reservoir at about 179 feet below the surface at full pool. Other than kokanee, most fish species are unlikely to sound to that depth, become entrained, and exit through the turbines. There is no good information on whether bull trout would sound to such a depth, but given the affinity for the bottom substrate during other life history stages, it is not unlikely. It is likely that bull trout sound to at least 90 ft. at Swift dam (see discussion below). The North Fork Lewis River hatchery and Merwin trap counts document only two bull trout/Dolly Varden in the past 20 years, indicating downstream movement and subsequent entrainment may be rare at Merwin Dam.

Yale

A large adult bull trout (710mm) captured from the Yale tailrace during the annual net and haul operation was tagged and placed in Cougar Creek. This same fish was recaptured the next year in the Yale tailrace (PacifiCorp 1999). This indicates entrainment does occur, probably through spill since it is unlikely a fish of that size would survive the turbines (Clay 1995). There is potential for injury or mortality to bull trout that are entrained through spill, due to the rough nature of the exit from the spillway and the confluence with the river. Causes for injury or mortality during spillway entrainment include abrasions, cavitation, impingement, and shear (Hamilton and Andrew 1954). PacifiCorp has agreed to address the Yale spillway during the relicensing process and is currently working on designs to make the exit more fish friendly.

Hydroacoustic studies conducted during the Yale relicensing effort (HTI 1997) indicated that approximately 780 fish per day with an estimated mean length of 130 mm were entrained at Yale. During the eleven week study, 52,594 fish were estimated to have been entrained through the turbines. The estimated mean lengths during the entire 11 weeks ranged from 70 mm during the first week up to a high of 160 mm in week two. Unfortunately, the sample period only covered from January 20 to April 4. The entrainment rate during the remainder of the year is unknown. Concurrent attempts to identify species of entrained fish through reservoir trawls yielded samples dominated by threespine sticklebacks and sculpins less than 50 mm in length. Thus, identification of the entrained fish species was inconclusive.

PacifiCorp and Cowlitz PUD (2000a) concluded that it was unlikely that bull trout were being entrained through the turbines using results from the HTI hydroacoustic study. This was based on the estimated size of fish entrained in the Yale turbine intake of 130 mm, and that Graves (1983) found bull trout to be greater than 295 mm by the time they entered Yale Lake. We believe that this conclusion is not supported by the evidence below.

The way that data are presented in Graves (1983) is somewhat ambiguous in this regard and is open to different interpretations. The FWS interprets Graves (1983) to say that juvenile bull trout found in several reservoir inlets ranged from age 0+ (110 - 150 mm) up through sub-adults at age 3+ (285 - 380 mm). Other investigators have also found that some 0+ fish out migrate from their natal tributaries into lakes or reservoirs (Riehle et al. 1997; Reiser et al. 1997). Riehle et al. (1997) found that 19% of the 0+ fish migrated out of their natal stream. The size of juvenile bull trout in that study ranged from 25 to 261 mm for 0+ to 4+ fish. Reiser et al. (1997) found that some bull trout fry out-migrate to Chester Morse Lake shortly after emergence. The sizes for 0+ bull trout in these studies are easily within the range of 70 - 160 mm documented by the 1997 HTI hydroacoustic study.

There is additional evidence that suggests bull trout may be entrained through the Yale turbines. Both Yale and Swift No. 1 turbine intakes are at similar depths and configuration. Some bull trout are sounding to the Swift No. 1 intake depth and being entrained through the turbines based on the bull trout found in the Swift No. 2 power canal (See discussion below). As a result, it is likely that juvenile bull trout may be entrained through the Yale turbines in the same way and at a rate proportional to their population size as at Swift No. 1.

In the technical report for the Yale license application, PacifiCorp (1999) states that similarly configured Francis turbines at other projects showed a mortality of between 9 - 39% (cited EPRI 1987). Using the most conservative estimate of 9% mortality, over 5,844 fish (unknown species mix) were killed during the 11 week period of the study (HTI 1997). This estimate does not account for any fish that may have been entrained outside of the study window.

The conclusion that bull trout are not being entrained is premature and can not be supported by the available information. Determining the rates, sizes and species composition of fish entrained through Yale turbines is one of the critical studies that should be completed during the relicensing process.

In their draft BA, PacifiCorp and Cowlitz PUD proposed to evaluate the effectiveness of a strobe light system. Testing of this system at various dams around the Northwest has shown some success as behavioral barriers to block fish, (Winchell et al. 1994; Ploskey et al. 1998; Mueller et al. 1999; Johnson et al. 2000) but results have been a mix of success and failure. Recent strobe light testing at Cowlitz Falls found that approximately seventy-five percent of the steelhead tested in 1999 were actually attracted to the lights (Evans et al. 1999). In addition, strobe light test results seem to be somewhat species and size specific and have never been tested specifically on bull trout (Rondorf 2001 Per Com). For these reasons, the FWS believes that other methods to deter entrainment at both Yale and Swift No. 1 must be investigated. After further review of the literature, and discussion with the Services, the applicant has dropped this evaluation.

Swift No. 1 and Swift No. 2

Few data are available on the entrainment issue at Swift No.1 and Swift No. 2. The information as discussed below indicates that bull trout are being entrained through the Swift No. 1 turbines. Hatchery fish planted in Swift provided 73.5% of the 1980 rainbow trout harvest in Yale (Graves 1983), but it is not known whether those trout emigrated through the turbines or the spillway. During opening day fishing in 1999 and 2000, the creel clerk reported that bull trout juveniles were captured in the Swift No. 2 power canal, indicating that entrainment likely occurred through the turbines at Swift No. 1 powerhouse. During August 2000, WDFW and PacifiCorp sampled the Swift power canal and Swift 1 tailrace and captured one bull trout 29 cm (11.5") long (Lesko

2001). A large bull trout was observed in the surge tank of the Swift No. 1 penstocks during the summer of 2000 (Lesko 2001). The most likely way for fish to get into the surge tank is through entrainment into the penstock. This represents an adverse effect in terms of isolation and also potential injury or mortality.

In September 1999, the WDFW and PacifiCorp placed nets in the Swift No. 2 tailrace to determine if a similar situation exists to that in the Yale tailrace. On October 12, 1999, two bull trout were caught in Upper Yale Lake at the upstream side of Swift No. 2 tailrace (PacifiCorp and Cowlitz PUD 2000b). It is unknown if these adult bull trout were entrained in spill from the Swift No.1 spillway, or if they were part of the Yale sub-population.

Although Swift No.1 does not spill frequently (PacifiCorp and Cowlitz PUD 2000b), there is good evidence that fish are spilled during these events. The configuration of Yale and Swift No.1 dams is similar and bull trout could reasonably be expected to react the same way at Swift No. 1 as at Yale during a spill. Therefore, there is reason to assume that a percentage of the Swift bull trout sub-population is being spilled into Yale Lake.

Graves (1983) found significant numbers of dead rainbow trout and other fish in the bypass reach after a spill event. It is our assumption that these fish were spilled from the Swift Reservoir. The exit of Swift No. 1 spillway is extremely rough and drops into the bypass reach from a significant height. Because of this configuration, survival may be low for fish that are entrained at Swift No.1. spillway. This, plus the lack of permanent instream flow, may explain why there have been few observations of adult bull trout in the Swift bypass reach.

The frequency of spill at the Swift No. 2 power canal is not known. Spill at the Swift No. 2 project is accomplished through an overflow spillway that diverts the water out of the power canal and into the Swift bypass reach (D. MacDonald - Cowlitz PUD Per. Com.). Whether bull trout leaving the canal would enter the Yale population gene pool is unknown. There are only two egress points for them; Swift No. 2 turbines or the overflow spillway. Any bull trout that were to exit the Swift No. 2 canal through the overflow spillway would likely survive but would be isolated from the Swift Reservoir sub-population. Bull trout entrained through the turbines at Swift No. 2 would have a risk of injury, but due to the lower head at the powerhouse, this risk should be less than at Yale or Swift No 1. dams.

Recent bull trout genetic comparisons from Spruel et al.(1998) indicate that the Swift bull trout sub-population differs significantly from those of Merwin and Yale. This may indicate that there was little genetic exchange between the two groups even before the construction of the projects, even though there were no known blockages preventing these two sub-populations from interbreeding. Migratory corridors link seasonal habitats for bull trout. The ability to migrate is important for the persistence of local sub-populations (USDI 1998a).

The Swift bull trout entrained through the turbines and possibly through spill, create a dilemma for fish management. Volitional passage is not available around the dam, but bull trout found in this area may need to be transported upstream of Swift Dam if that is where they originated. It would be difficult to determine, however, if bull trout found in the vicinity of the Swift No. 2 tailrace or the Swift bypass were from the Swift or Yale sub-population. Relicensing studies are being designed to look at providing passage facilities at Swift No. 1 and Swift No. 2 . If passage is provided bull trout captured in the Swift No. 2 tailrace may need to be genetically evaluated to determine from which population they originated.

Although the data are not definitive, we believe that entrainment occurs at some level at each spillway and through each turbine for Yale, Swift No. 1 and Swift No. 2. In conclusion, entrainment at the Yale and Swift hydroelectric facilities has the potential to significantly affect adult and sub-adult life stages of bull trout in those populations. These effects include isolation, injury, and mortality. These issues will be addressed through studies proposed by the participants of the ALP during relicensing.

OPERATIONAL EFFECTS

Instream flow below Merwin may have an adverse effect on anadromous fish stocks. Project flow patterns are close to historic with the exception of reducing peak seasonal flows. Reducing peak flushing flows might affect downstream channel morphology and therefore the substrate and cover habitat requirements of all three ESUs. Under relicensing, there will be a scientific review of the flows to insure applicability to the other listed, proposed and candidate species.

Instream flow in the Swift bypass reach is the subject of much discussion in the ALP. Additional analysis will be conducted as part of an Instream Flow Incremental Methodology study. Lack of instream flow in the bypass reach may reduce potential spawning and rearing habitat for the Yale bull trout population.

Presently, the Merwin license required ramping rate downstream of Merwin Dam is 1.5 feet per hour down-ramping and 1.0 feet per hour up-ramping. These ramping rates represent fairly rapid changes in river stage and consequently may strand juveniles or fry of all three anadromous ESUs. Proposed interim ramping rates are likely to reduce the potential for stranding. However, even the new ramping rates may adversely effect anadromous fish stocks and therefore need~~s~~ further review. To that end, the proposed action includes a stranding study (Table 3) with the results being incorporated into the long-term plan to reduce adverse effects prior to relicensing.

Since the Yale and Swift No. 2 tailraces empty directly into their respective downstream reservoirs, ramping is not an issue.

Currently, PacifiCorp and Cowlitz PUD use Swift No. 1, Swift No. 2 and Yale as power peaking facilities. Peaking can cause temperature fluctuations and elevated total dissolved gases (TDG) in the tailraces. Studies by PacifiCorp have addressed the issue at Yale and have resolved TDG saturation such that levels above WDOE water quality standards are minimized through modification of turbine aeration valves (PacifiCorp 1999). Additional studies were recently conducted at the Swift Projects, the results of which are being analyzed. Temperature effects are still being evaluated and are to be addressed through relicensing. The WDOE is requesting that PacifiCorp and Cowlitz PUD determine if there are any adverse biological effects on bull trout. Thus far, no observable effects have been noted. However, PacifiCorp and Cowlitz PUD will continue to examine the conditions to address the issues.

Operation of the North Fork Lewis River projects can have mixed effects on North Fork Lewis River listed, proposed or candidate salmonids. Formation of the reservoirs has provided refuge and forage for adult and juvenile bull trout. Seasonal drawdowns may have some non-specific impact such as concentration of predators and prey. Other operational impacts include instream flow, spill and power peaking. Spill at Yale and Swift No. 1 may cause injury and may even cause mortality due to configuration of the spillways.

There are many project operational impacts that can have adverse impacts on the environment and listed species. The continued existence of the dams may affect downstream channel morphology and the habitat requirements of substrate and cover. Just a few examples of potential operational impacts include; effects on channel morphology, trapping sediment and nutrients and effects on riparian vegetation. These riparian characteristics have a direct correlation to spawning and rearing success for all species and therefore the overall health of the system. The studies specified in Table 3 are assessing the effects of the projects in floodplain and riparian habitats and on geomorphic processes, including channel morphology, sediment supply and transport, and LWD supply and transport. The proposed action includes development of a long-term plan to reduce adverse effects, which will be incorporated into relicensing efforts.

Historically, PacifiCorp has met or exceeded requirements of the Merwin license for streamflows and ramping rates with a few exceptions in 1998 and 1999. On June 4, 1999, the FWS sent a letter to FERC outlining ~~our~~ concerns about these exceptions. Two incidents in 1998 were reported to the FWS Western Washington Office, one of which was attributed to operator error. Equipment failures at Merwin Dam on Friday June 4, 1999 and Sunday June 6, 1999, resulted in the loss of 76 adult spring chinook and 25 adult steelhead in the fish trap and a large number of juvenile wild fall chinook stranded downstream of Merwin Dam. The State of Washington assessed PacifiCorp a damage claim of $705,548 for these incidents. PacifiCorp and the State are still discussing the claim and the appropriate mitigation or enhancement related to the fish kill. However, as a result of initial discussions with WDFW, PacifiCorp established a new set of operating protocols to reduce the probability of any recurrences. Recent correspondence documents the agreement between PacifiCorp and WDFW (PacifiCorp and Cowlitz PUD 2000b). This action will reduce the risk of future dewatering and therefore increase the likelihood that the 'migration and hydrologic factors' habitat requirements of listed species will be met compared with the historic environmental baseline.

Table 5. Summary of Major Project Effects and Proposed Conservation Measures on the Lewis River fish species.

Project Name	Effect	Relative significance
Upstream Fish Passage		
Merwin Dam	Blocks anadromous fish access to upstream habitat	significant
Merwin Dam	Isolation of bull trout from spawning population	unlikely to be occurring
Yale	Isolation of bull trout from spawning population	documented and significant
Swift No.1 and Swift No. 2	Isolation of bull trout from spawning population	assumed to be occurring
Entrainment (involuntary downstream bull trout passage)		
Merwin	Probably no effect	unlikely to be occurring
Yale	Isolation, injury and mortality	significant
Swift No.1 and Swift No. 2	Isolation, injury and mortality	assumed to be occurring
Operations		
Merwin Dam	Instream flows and ramping rates can cause stranding and anadromous fish losses	may be significant
Merwin	Probably no effect on bull trout	unlikely to be occurring
Yale	Bull trout injury and mortality from spill	may be significant
	Possible concentration and increased predation on bull trout	may be occurring but effect is assumed minimal
Swift No.1 and Swift No. 2	Bull trout injury and mortality from spill	may be significant
	Possible concentration and increased predation on bull trout	may be occurring but effect is assumed minimal
Conservation Measures		
Merwin	Protection of anadromous fish rearing habitat	long term beneficial effect
	Alteration of ramping rate affecting anadromous fish	long term beneficial effect
	Net and Haul for bull trout	Decreased effects of entrainment
Yale	Protection of bull trout spawning and rearing habitat	long term beneficial effect
Swift No.1 and Swift No. 2	Protection of bull trout rearing habitat	long term beneficial effect

CONSERVATION MEASURES

The proposed conservation easements will result in increased protections for the adjacent riparian zone beyond that currently required by the Washington Forest Practices Act and associated regulations. The proposed width of these easements will protect the intact riparian zone, preserve the function and provide a significant buffer to the riparian zone. Protection of these riparian areas will preserve and enhance spawning and rearing habitat for bull trout in Cougar Creek and the Swift Creek Arm of Swift Reservoir by reducing the effects of upslope activities.

The net and haul program in the Yale tailrace will continue to reduce the effects of downstream entrainment of adult bull trout through the spillway. As discussed previously, the contribution of these bull trout to the spawning population in Cougar Creek is significant.

Purchase and protection of Eagle Island provides protection of over 70 percent of the present day wild fall chinook rearing habitat associated with the lower Lewis River. The island also provides important habitat for adult and juvenile steelhead, coho, chum and cutthroat (WDFW 1998). PacifiCorp, through agreement with Clark County, provided the county's portion of the funding to purchase the island and deed the property to the State. This has allowed Clark County to use its funds to protect and restore salmon and steelhead rearing areas through their Conservation Futures program to improve the habitat on the island for wildlife, and set up a fund for continued preservation of Eagle Island. Results of this action will be to provide valuable benefits to the anadromous salmonids in the lower Lewis River.

This action will not result in a change in current baseline conditions because it preserves already-existing spawning and rearing habitat. However, it is important because it prevents additional loss of rearing habitat due to timber harvesting and development. The effect of this action is to improve the future survival (both throughout the period covered by this opinion and in future years) of CR chum, LCR chinook, and LCR steelhead by avoiding additional losses of this crucial habitat.

INDIRECT EFFECTS AND INTERRELATED AND INTERDEPENDENT ACTIONS

Interdependent actions are those that have no independent utility apart from the action under consideration (50 C.F.R. § 402.02). Indirect effects are effects that are caused by the action but are later in time. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. These indirect effects, interrelated and interdependent actions include hatchery and harvest practices, recreation in the basin, roads, and lack of anadromy in the upper basin.

Factors such as hatchery practices and fish management influence the listed, proposed and candidate species. Introduction of non-native fish can negatively effect listed species by increasing competition for food, hybridization, loss of genetic fitness, and increased predation on listed species. As stated earlier, impacts to all listed species are being addressed through separate consultations during the development and evaluation of the HGMP. There may be beneficial effects on listed species if the introduced fish become a significant prey base.

Fishing regulations, such as size and gear restrictions and possession limits, can affect listed species. The section 4(d) rule published with the listing of bull trout allows incidental catch of bull trout when legally fishing for other fish species. Currently, it is illegal to catch and keep bull trout in the Lewis River sub-basin.

As shown in Figure 7, historic catch rates of bull trout in Yale were significant but declining. PacifiCorp (1999) reported 16 bull trout caught of which 15 were released during a 1996-97 creel census conducted as part of the Yale relicensing. The 1999 creel survey report (Tipping 2000) indicates that in over 10,000 angler-hours, seven out of 2,151 fish captured were bull trout (PacifiCorp and Cowlitz PUD 2000a). Unfortunately, Tipping (2000) reported that less than half of the anglers interviewed could correctly identify bull trout.

The large size of Yale and Swift reservoir and the limited sampling make it likely that the recent creel census underestimated the actual catch and/or possession of bull trout. Hooking, even if the fish are released, can result in acute or chronic injuries, increased susceptibility to diseases, and potentially death. Handling hooked fish before releasing them also contributes to mortality.

Catch and release fishing can cause mortality ranging from 3.9% for fly-caught fish up to 58% for bait caught fish (Schisler and Bergersen 1996; Pauley and Thomas 1993; Warner et al. 1978). Using the 2 creel surveys discussed above, and the bait caught estimates of mortality, at least 8 bull trout died in 1996 and > 3 bull trout died in 1999-2000 as a result of angling.

One of the most susceptible areas for incidental bull trout catch is in the Swift power canal due to easy access and heavy fishing pressure. Poaching and directed targeting of bull trout has occurred in the upper Swift Reservoir area. This resulted in a proposal to completely close a stretch of the North Fork Lewis River just above the reservoir to fishing. The proposal was rejected by the Washington Fish and Wildlife Commission but a change to non-bait gear (with single barbless hooks)was approved. This change may reduce the mortality of bull trout from angling but will need to be monitored closely. Due to the large area to patrol and the limited availability of law enforcement officials, there is still potential for poaching in the area of the Swift projects.

Localized and dispersed recreational use within the Lewis River sub-basin has the potential to affect bull trout. People that use this recreational area are drawn to water and engage in activities that have may adversely affect bull trout populations and habitat. Recreationists take part in a variety of activities, including camping, hiking, boating, fishing, and swimming in areas that may affect bull trout. The effects include large wood removal by recreationists for firewood, and changes in streambank conditions due to trampling along bull trout streams.

The only recreational area managed by the licensees near bull trout habitat is the campground at the mouth of Cougar Creek. The effects on bull trout within the project boundaries are believed to be minimal because most of the recreational focus is on the reservoir and not on Cougar Creek. In addition, the Cougar Creek campground is closed before adult bull trout begin their spawning run into Cougar Creek.

Roads contribute more sediment to streams than any other land management activity (Gibbons and Salo 1973; Meehan 1991), and most of the land management activities are dependent on roads. Road-related mass soil movements can continue for decades after roads have been constructed (Furniss et al. 1991).

Roads are recognized as a long term source of sediment for extended periods even after erosion control measures have been implemented (Furniss et al.1991, Belt et al. 1992). Removing vegetation and ditch rock can increase downstream sedimentation. Lack of adequate culvert cleaning before winter storms can result in major mass wasting and extreme sedimentation for miles downstream. Such habitat alterations can adversely affect all life-stages of fishes, including migration, spawning, incubation, emergence, and rearing (Furniss et al. 1991; Henjum et al. 1994; Rhodes et al. 1994).

The land along Cougar Creek that PacifiCorp recently purchased has several miles of old logging roads. These roads could cause habitat degradation in Cougar and Panamaker Creeks as discussed above. PacifiCorp is aware of this problem and is working on a road management plan to minimize the potential for detrimental effects to Cougar Creek bull trout habitat. The land purchased by Cowlitz PUD along the Swift Creek Arm of Swift Reservoir has several miles of logging roads. These roads are mostly located above the steep section adjacent to the reservoir but they have the potential to cause effects downstream.

Lack of anadromy in the upper basin as a result of the project has indirect effects by preventing marine nutrients from entering the upper basin. The reduction of these nutrients may limit the available food, especially macro-invertebrates, for listed species. A lack of anadromous juveniles has severely reduced the available prey base in the upper watershed.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Above Yale dam there are several thousand acres of non-Federal lands. Most of these lands are used for timber production. The non-Federal lands surrounding Cougar and Pine Creeks are of critical importance due to the presence of spawning and rearing bull trout.

The lands immediately adjacent to Cougar Creek are primarily owned by PacifiCorp, but the upper watershed of Panamaker Creek, a major tributary of Cougar Creek, is owned by private timber companies. Timber harvest and road building in the upper Panamaker Creek basin could have a downstream effect on bull trout habitat in Cougar Creek, but activity in this drainage is not anticipated between now and when the relicensing consultation is completed.

The town of Cougar, a highway, and several campgrounds occur along or have the potential to affect Cougar Creek. Management of these lands and facilities are not expected to appreciably change in the near future; therefore, impacts on bull trout and their habitat have already occurred and would likely maintain the status quo with the exception of potential poaching of bull trout at one of the campgrounds. The current State of Washington fishing regulations prohibit keeping bull trout if captured while fishing for other species.

Land management activities along Pine Creek pose the most serious cumulative effects threat to bull trout in the Lewis River watershed. Pine Creek is one of only two known bull trout spawning and rearing tributaries to Swift Reservoir. Most of the Pine Creek watershed is owned by Plum Creek Timber Company and the effects of their actions have been covered in an amendment to their HCP (USDI 1998c).

Several private vacation homes and lots also occur in the headwaters of several tributaries to Pine Creek. The activities associated with the vacation homes do not appear to be affecting bull trout habitat. Expansion of the summer homes or activities associated with the existing homes is not anticipated.

There are no other known bull trout streams on non-Federal lands in this area. Therefore, current and expected future management actions on non-Federal lands not associated with Cougar or Pine creeks are not anticipated to have cumulative effects on bull trout because no suitable or accessible habitat exists on those lands. No downstream effects on known or potential bull trout habitat from actions on non-Federal lands are expected outside Pine and Cougar Creeks.

One exception may be land management activities that may affect upper Swift Creek, where pockets of cold water and, therefore, potentially suitable bull trout habitat occur. Bull trout are known to use Swift Creek Arm of Swift Reservoir but their occurrence in Swift Creek above the falls is unknown. A large waterfall barrier (80 feet high) exists on lower Swift Creek restricting upstream migration1 of those bull trout occupying Swift Reservoir. Past and future timber harvest activities on non-Federal lands surrounding Swift Creek may increase sedimentation into nearby streams potentially degrading habitat quality in Swift Creek. Sediment entering Swift Reservoir from these actions would likely have minimal effects on adult bull trout in Swift Reservoir unless landslides or road failures occur.

The persistence of bull trout in Swift Reservoir appears to hinge on Pine Creek, which is unstable, and Rush Creek, which provides limited habitat. It is not known to what degree the Rush Creek bull trout could sustain the sub-population if the Pine Creek population is adversely affected . However, after the eruption of Mt. St. Helens in 1980, when bull trout habitat throughout the Pine Creek drainage was severely altered (Faler and Bair 1996), it was assumed that migratory bull trout from Rush Creek subsequently recolonized Pine Creek. The ability of the Swift Reservoir sub-population to be able to rebound from multiple stochastic events is not known, but is in question given the sub-population's status as depressed but stable (USDI 1998a).

Due to a canyon, the Lewis River downstream of Merwin dam is relatively protected from most anthropogenic impacts for 4 miles. This is the area where most anadromous fish spawning takes place. This stretch of river contains high amounts of quality gravel (Stillwater 1998). In the first 15 miles of the lower river considerable diking and development has occurred which has affected rearing habitat. While such developments are outside the utility's control, actions such as the purchase and protection of Eagle Island provide substantial benefits to rearing habitat that are otherwise could be lost permanently to developmental pressures.

CONCLUSION

The Lewis River baseline conditions are presented in the Status of Species and Environmental Baseline sections above. Direct and indirect effects of ongoing operations and the proposed action, their interrelated and interdependent activities' effects, and future cumulative effects on bull trout, salmon and steelhead, are summarized in the Effects sections above.

Bull Trout

The FWS has reviewed the current status of bull trout in the Columbia River Distinct Population Segment, and the environmental baseline for the Lewis River sub-basin. The FWS has also reviewed effects of the proposed action and ongoing operations of the project on bull trout, and the anticipated cumulative effects. These potential effects are being reduced by implementation of PacifiCorp's and Cowlitz PUD's proposed conservation measures. It is the FWS's biological opinion that the proposed action in the Lewis River sub-basin, as proposed, is not likely to jeopardize the continued existence of the bull trout. No critical habitat has been designated for this species; therefore none will be affected.

The FWS does not believe that the proposed action and the operations of the Lewis River hydroelectric project will jeopardize the continuing existence of the listed Columbia River DPS of bull trout for the following reasons:

1. There are 141 sub-populations of bull trout in the Columbia River DPS. These are distributed over Washington, Oregon, Idaho, Montana and British Columbia. The Lower Columbia Geographical Area contains 20 sub-population in nine major tributaries of Washington and Oregon below the Snake River. The Yale and Swift sub-populations are two of 141 (1.4 percent) sub-populations within the Columbia River DPS and two of 20 (10 percent) of the Lower Columbia Geographical Area.

2 The distance from the Yale sub-population to the next closest sub-populations (103 to 114 miles) is significant. It is unlikely that any significant interchange between the Lewis River bull trout and the closest sub-population is possible without human intervention. The Columbia River has unsuitable temperatures most of the year, the distance between these sub-populations is significant, and Bonneville dam likely would affect any migrations. Therefore, the Lewis River sub-populations will need to continue to survive in isolation from other sub-populations.

3. The Swift sub-population was considered depressed but stable in 1998 (USDI 1998a). Population estimates since then seem to be showing an upward trend although this is not statistically significant (Figure 8). Since Swift bull trout are upstream from Yale, they could recolonize the downstream population over an extended period of time. Population estimates for the Yale sub-population are variable but seem to be stable.

4. Harm, harassment and mortality of bull trout may occur from the Merwin Dam at RM 20 to the upper extent of accessible habitat in the upper North Fork Lewis River. However, project operations have been relatively unchanged since the projects were constructed and while bull trout populations are depressed, populations appear to be stable or increasing under current operations.

5. Changes to operations that may affect bull trout such as reducing total dissolved gases in the Yale tailrace have resulted in benefits to the species.

6. The foraging habitat within the affected area will not be changed by the continuing operations or the proposed conservation easement. The spawning habitat for adults lies upstream of the projects effects and would not be adversely impacted. Stream rearing and spawning habitat is not affected by project operations. Existing survey data indicate that most of the bull trout occur in Swift Reservoir and upstream of the project.

7. PacifiCorp and Cowlitz PUD have committed to the conservation measures in the draft BA (PacifiCorp and Cowlitz PUD 2000b). These measures will provide for long-term restoration and enhancement of refuge habitat for bull trout by protecting Cougar Creek and allowing it to develop increasing habitat complexity and by reducing the risk of road failure and increased sedimentation. Conservation measures proposed that reduce take or protect bull trout habitat include: the net and haul program below Yale dam and the conservation easements along Cougar Creek and Swift Arm.

8. The recently implemented net and haul program has reduced the number of adult bull trout that are isolated from Cougar Creek. An average of 21 % of the Cougar Creek spawners annually were fish that had been trapped and transported above Yale dam. The program is too recent to be able to predict long term results, but to date no fish have been injured because of the transport.

Given the above information the FWS does not believe that the proposed action will result in jeopardy to the Columbia River DPS. The action includes the operations of the Lewis River projects which have not changed appreciably since relicensing of Merwin in 1989. The only changes to operations have been beneficial. Populations seem to be stable or increasing. Bull trout habitat is either above the project influence zone or will not change due to the proposed action. The WDFW initiated regulations preventing anglers retention of bull trout in the early 1990s. A change in regulations to catch and release above the project using single barbless hooks should reduce the handling injury and mortality associated with incidental bull trout catch by anglers.

Salmon and Steelhead

NMFS has reviewed the status of LCR chinook salmon, LCR steelhead, and CR chum salmon and the environmental baseline for these ESUs within the action area. NMFS has also reviewed the effects of the proposed action during the interim period represented by this action, as well as anticipated cumulative effects. NMFS finds that:

1. The biological requirements of LCR chinook salmon, LCR steelhead, and CR chum salmon are not being met in the action area under the environmental baseline.

2. The proposed action includes various known and potential adverse effects, the most significant of which is continued blocked passage to historical spawning and rearing areas above Merwin Dam for LCR chinook and LCR steelhead. Water management and project operations also likely affect spawning and rearing success in the river reach below Merwin Dam.

3. The proposed action represents a reduction in adverse effects, compared to current conditions associated with the environmental baseline, for at least two ESUs (LCR chinook and LCR steelhead) by: (a) modifying ramping rates to reduce the likelihood of stranding, and (b) installing new equipment and operating procedures to reduce the likelihood of dewatering the river immediately below Merwin Dam and stranding LCR chinook. These components of the proposed action should improve environmental baseline conditions.

4. The Eagle Island purchase represents a reduction in adverse effects to all three ESUs that are likely to be caused by third parties in the future if the current environmental baseline trend were to continue towards loss of spawning and rearing habitat. The effect of this action is to improve the future survival (both during the time period covered by this opinion and in future years) of LCR chinook salmon, LCR steelhead, and CR chum salmon by avoiding additional losses of this crucial habitat.

5. There is currently little information regarding some of the known or potential adverse effects of the proposed action on listed ESUs, but the proposed action includes studies to be completed during the interim period that will evaluate the most uncertain project effects, and the resulting information will inform development of an effective long-term plan for re-licensing.

   Results of the Merwin Streamflow and Ramping Rate Study and the Stream Channel Morphology and Aquatic Habitat Study (Table 3) will be used to determine if ramping rates or streamflows below Merwin Dam should be modified during relicensing to further prevent stranding and to provide adequate spawning and rearing habitat.

   Results of the Engineering Feasibility Study for Fish Passage Facilities and the Assessment of Potential Anadromous Fish Habitat Upstream of Merwin (Table 3) will, along with new information expected from NMFS' Technical Recovery Team, inform development of a long-term plan to address blocked passage as a component of relicensing.

   Although these studies will not immediately increase survival and distribution of these ESUs, they are necessary first steps towards developing long-term plans that will result in improvements.

6. Available information is insufficient for determining if the proposed action will improve the status of the listed ESUs to the point at which biological requirements will be fully met within the action area. However, ongoing NMFS Technical Recovery Team efforts and proposed action studies to be completed during the interim period (date of this opinion through 2006) are expected to generate much of the needed information.

7. Although some uncertainties exist, the best available information suggests that the three listed ESUs will continue to survive and retain the potential to recover if the proposed action is implemented during the interim period. Because the proposed conservation measures will provide the benefits as described above, NMFS concludes that these benefits will be sufficient to reduce the likelihood of extinction while studies are completed. Therefore, NMFS concludes that the proposed action, together with the effects of the environmental baseline and cumulative effects, is consistent with the biological requirements and not likely to jeopardize the continued existence of LCR chinook salmon, LCR steelhead, or CR chum salmon or result in the destruction or adverse modification of their designated critical habitat in the time period from the date of this opinion through 2006.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Services to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Services as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by FERC, PacifiCorp, and Cowlitz PUD and made binding conditions of any license or permit issued, as appropriate, for the exemption of section 7(o)(2) to apply. FERC has a continuing duty to regulate the activity covered by this incidental take statement. If FERC (1) fails to assume and implement the terms and conditions, or (2) fails to require applicants to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or license document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the action agencies must report the progress of the action and its impact on the species to the Service's as specified in the incidental take statement.

This biological opinion and incidental take statement analyzes the effects of the action and the likelihood of extinction through 2006, the date of expiration of the Merwin, Swift No. 1 and Swift No. 2 licenses. (Note: the Yale project's license expired in 2001) The Services hold the reasonable expectation that this biological opinion will be superseded by a subsequent one upon issuance of new licenses in 2006. If FERC has not issued new licenses by April, 2006, the Services expect that reinitiation of consultation would be required based on the regulatory requirements set forth at 50 CFR §402.16. (See four factors pursuant to 50 CFR §402.16 in the Reinitiation Notice section) The Services shall analyze PacifiCorp and Cowlitz PUD's annual report using these 4 factors to determine if re-initiation of consultation is required. If the Services determine that re-initiation is warranted, PacifiCorp and Cowlitz PUD consent to the consultation and shall remain in compliance under the current ITS until consultation is completed. If the Services determine that reinitiation is warranted, but consultation is not reinitiated for whatever reason, this biological opinion and incidental take statement shall no longer be in effect beyond April, 2006.

AMOUNT OR EXTENT OF INCIDENTAL TAKE

The Services anticipate that the activities associated with PacifiCorp's and Cowlitz PUD's operations of the Lewis River hydroelectric projects are likely to result in unquantifiable levels of incidental take of bull trout, chum and chinook salmon and steelhead trout in the North Fork Lewis River sub-basin. For operations that do not involve entrainment, it is difficult to quantify the numbers of fish species that are taken for all of the project effects due to:

- The limited scope, timing, and sampling locations of existing monitoring programs which may detect the number of bull trout entrained or anadromous fish affected by flow changes or development;
- The unlikely occurrence of finding an individual death or injury, and relating it to the proposed action given the relatively low density of bull trout in the North Fork

Lewis River, water depth and scavengers, or the difficulty in determining project-related anadromous fish take in the lower 19 miles of the Lewis River;

- Bull trout may be affected by factors occurring upstream of the projects and salmon and steelhead affected by non-project related factors occurring downstream of the projects;

- Dead or impaired specimens may be washed downstream of the site where the impact occurred, fish decompose very rapidly and losses may be masked by seasonal fluctuations in numbers or other causes.

For operations that involve entrainment, the FWS believes that specific take of bull trout due to entrainment is occurring at Yale and Swift No. 1 turbines and spillway and Swift No. 2 turbines. Table 6 shows that the number of bull trout netted in the Yale tailrace has ranged up to 15 fish annually since the net and haul program began in 1995. It is not known conclusively if these fish were entrained over the spillway or through the turbines, but for this analysis we assume that they were entrained at the Yale spillway. The FWS assumes this same level of take at the Swift No.1 spillway based on the similarity of the two spillways.

Table 6. Number of bull trout collected from Yale tailrace (Merwin reservoir) and transferred to the mouth of Cougar Creek (Yale tributary): 1995 – 2000.

YEAR	No. captured at the Yale tailrace (not including recaptures) *	No. transferred to mouth of Cougar Creek (not including recaptures)*	No. released back into Merwin reservoir.
1995	15	9	6
1996	15	13	2
1997	10	10	0
1998	6	6	0
1999	6	0	6
2000	7	7	0
Average	**9.8**	**7.5**	**2.3**

Take of bull trout at the Swift No. 1 and Swift No. 2 turbines is based on a one year creel census (2 fish caught in the power canal) and the single (1) bull trout found in the surge tank at Swift No.1. Anglers have indicated that they occasionally catch bull trout in the canal but the confidence in these identifications is low. The FWS has determined, therefore, that the annual take through the turbines at Swift No.1 and in the power canal of Swift No.2 may be as high as 3 bull trout but is likely lower. Because the configuration of the intakes at Yale is similar to those at Swift No.1, the estimate of take at the Yale turbines is likely 3 or less since the Swift sub-population is considered to be much larger than Yale.

Table 7	Swift 1 and 2 turbines	Swift 1 spillway	Yale turbines	Yale spillway	Total annual take
Assumed maximum annual bull trout take	≤ 3	≤ 15	≤ 3	≤ 15	≤ 36

Because of the qualitative nature of this data, we are only using it to identify a maximum number of fish that may be entrained through the turbines at all of the projects. We believe that the maximum annual total take of bull trout for the operations of the Lewis River hydroelectric projects is 36 but is likely lower (See Table 7 above).

We have 6 years of data for the netting program that is useful for deriving estimates of take resulting from entrainment through the spillway at Yale. The FWS, therefore, will base the incidental take statement on these data. The average number of fish collected during these years is almost 10 fish, although there seems to be a downward trend in the number of bull trout netted annually (See figure 9). Using this average as an annual take estimate for the period between now and 2006**,** the number of fish netted between the 2001 field season and 2006 field season would be 60 fish. The estimated incidental take for 2001 through 2006 will be 60 bull trout. The number of fish netted will be evaluated each year and compared to the average of 10 fish. Based on this evaluation, using the 3 year rolling average, if the projected number of bull trout netted will be more than 60 by 2006, this would indicate that the authorized incidental take may be exceeded and reinitiation or measures to reduce this take would be required.

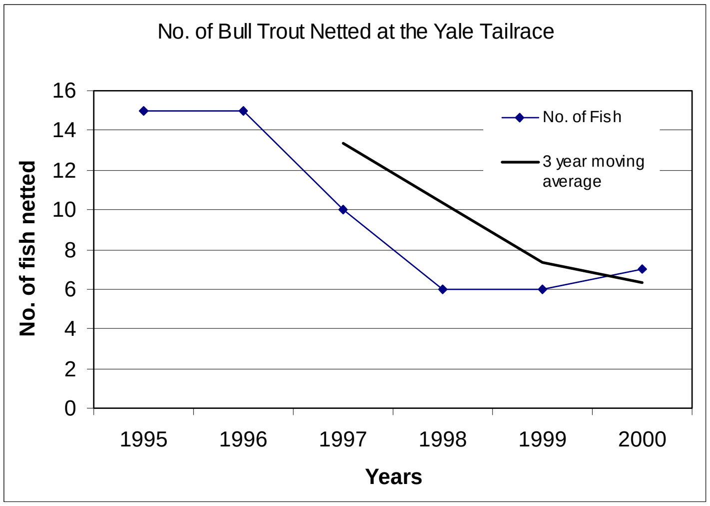

Figure 9

The Services anticipate that the following forms of take could occur as a result of the activities associated with the projects.

Merwin Dam and Lake Merwin

Blocked access to spawning and rearing habitat upstream of Merwin Dam is expected to result in an unquantifiable incidental take of LCR chinook salmon and LCR steelhead during the interim period.

Modification of flows (e.g., dewatering due to operator error or equipment failure) and other effects that may modify habitat spawning and rearing habitat downstream of Merwin Dam are expected to result in an unquantifiable incidental take of LCR chinook salmon, LCR steelhead, and CR chum salmon during the interim period.

Yale Dam and Lake

- Take of migratory bull trout in the form of harm below Yale Dam by impeding upstream passage and isolating adult fish from their spawning stream.
- Take of migratory bull trout in the form of harm, wound or kill by entrainment during spill or through the turbines.
- Take of migratory bull trout in the form of harm, wound or kill through potential supersaturation of dissolved gas during certain operations at Yale and Swift projects

Swift No.1 and Swift No. 2

- Take of migratory bull trout in the form of harm, wound or kill at Swift No. 1 Dam by entrainment during spill or through the turbine.
- Take of migratory bull trout in the form of wound or kill at Swift No. 2 powerhouse by entrainment through the turbine.

- Take of migratory bull trout in the form of harm at Swift No.1 and Swift No. 2 by impeding upstream passage and isolating adult fish from their spawning streams.

The Terms and Conditions for implementing the Reasonable and Prudent Measures of this biological opinion are anticipated to minimize the level of incidental take.

EFFECT OF THE TAKE

In this biological opinion, the Services determine that this level of anticipated take is not likely to result in jeopardy to the species.

REASONABLE AND PRUDENT MEASURES

Section 7 of ESA requires the development of reasonable and prudent measures (RPM) necessary or appropriate to minimize the level of incidental take. RPMs can include only actions that occur within the action area and reduce the level of take associated with project activities. The test for reasonableness is whether the proposed measure would cause more than a minor change to the proposed location or would alter the basic design, location, scope, duration or timing of the proposed actions. Since the Lewis River projects encompass most of the North Fork Lewis River drainage, many of the reasonable and prudent measures, and associated terms and conditions, should be implemented at that same scale.

With implementation of these Reasonable and Prudent Measures, the Services believe that take of bull trout, chum and chinook salmon and steelhead trout in the form of harm, harassment, and/or killing, from the applicants' project operations, will be reduced. As a consequence, the Services believe the following RPMs are necessary and appropriate to minimize impacts of incidental take of bull trout, salmon and steelhead in the Lewis River Basin.

Measures Specific to Bull Trout (FWS RPM's)

1. Protect bull trout spawning and rearing habitat.
2. Avoid or minimize effects to bull trout migration to spawning areas.
3. Develop information on the scope and effects of entrainment on bull trout as part of relicensing to provide for more informed decision about the need and/or design to reduce entrainment of bull trout.
4. Monitor spawning and rearing populations of bull trout in the North Fork Lewis River above Yale Dam for the Yale and Swift sub-populations as part of relicensing. Data will be analyzed during relicensing consultation to develop specific Terms and Conditions to minimize take for the next licensing period.
5. Monitor bull trout habitat conditions in Cougar Creek to provide early detection of any potential habitat damage.
6. Minimize downslope sedimentation in Cougar Creek from abandoned and active logging roads in the drainage.
7. Maintain or restore water quality to State standards.
8. Assure effectiveness of conservation measures by implementing management plans and conservation measures.

The FWS believes that a phased approach, involving application of the principals of adaptive management, is the most appropriate course of action in providing measures to minimize the take of bull trout. These factors were considered in our analysis of effects, as additional considerations to the features of the ongoing operations. Additional measures to minimize incidental take are not needed for some of these factors. For other factors, additional information is needed and is being addressed during the broader relicensing process. In those instances where additional measures are determined to be necessary to minimize incidental take, they will be developed as terms and conditions during the consultation for relicensing of the Lewis River projects.

Measures Specific to Salmon and Steelhead (NMFS RPM's)

1. Protect anadromous fish rearing habitat downstream of Merwin Dam.
2. Reduce the likelihood of take by minimizing the possibility of stranding due to ramping.
3. Reduce the likelihood of take caused by accidental stream channel and adult salmon trap de-watering.
4. Conduct studies to be completed during the interim period, which are necessary to determine and implement appropriate long-term operations with reduced levels of incidental take (see Table 3).

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the ESA, FERC must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. PacifiCorp and Cowlitz PUD have indicated in the biological assessment and applications to amend the licenses that they are committed to implementing the terms and conditions to protect listed species within the Lewis River project area. In the event that there are any inconsistencies or discrepancies between these terms and conditions and FERC's final order approving the applications to amend the licenses, PacifiCorp and Cowlitz PUD shall be in compliance with the ESA if PacifiCorp and Cowlitz PUD comply with the terms and conditions in this Incidental Take Statement. These terms and conditions are non-discretionary.

Terms and Conditions Specific to Bull Trout

The following terms and conditions specific to bull trout are necessary for the implementation of FWS RPM 1.

1. Within 30 days of the FERC issuance of the final order approving the application to amend the license, FERC shall direct PacifiCorp to record their proposed conservation easement along Cougar Creek and Panamaker Creek. This easement shall be at least 500 feet measured horizontally on either side of the high water mark along Cougar Creek but shall not extend past the toe slope of the road to the south of Cougar Creek. The easement may be expanded by mutual agreement of PacifiCorp and the FWS if needed to ensure the protection of Cougar Creek. The Panamaker Creek easement shall be at least 200 feet measured horizontally on either side of the high water mark or greater if agreed to by PacifiCorp and the FWS. It will follow the property boundary if < 200 feet as approximated on Figure 3. If during layout, obvious areas of slope instability are encountered, the conservation easement boundary shall be expanded to include the areas of instability.

2. Within 30 days of the FERC issuance of the final order approving the application to amend the license, FERC shall direct PacifiCorp to record their proposed conservation easement along the Swift Creek arm of Swift Reservoir. The easement shall include all of PacifiCorp lands adjacent to the Swift Creek Arm as identified on Figure 4.

3. Within 30 days of the FERC issuance of the final order approving the application to amend the license, FERC shall direct Cowlitz PUD to record their proposed conservation easement along the Swift Creek arm of Swift Reservoir. The easement includes part of

the area above PacifiCorp lands on the east side of Swift Creek Arm as approximated on Figure 4.

The following terms and conditions are necessary for the implementation of FWS RPM 2.

1. To carry out license Article 51, PacifiCorp shall continue to develop annual plans and fund the cost of operating the net and haul system in place at Yale tailrace. These plans shall be developed in consultation with WDFW and the FWS. Netting shall be completed at least weekly as soon as migratory adult bull trout are present and Merwin Reservoir levels permit safe working conditions in the Yale tailrace. If it is apparent that fish are being delayed past their appropriate ripening date, the net and haul shall be conducted twice weekly. Applicant maintains a section 10a(1)A permit to carry out this trap and haul operation.

2. PacifiCorp shall continue, in coordination with Cowlitz PUD, the net and haul program and sampling at the Swift No. 2 tailrace and the Swift bypass reach. FERC shall direct Cowlitz PUD to continue its involvement in the bull trout monitoring program at the Swift 2 tailrace.

3. FERC shall direct PacifiCorp to evaluate the feasibility of reestablishing bull trout passage at Yale dam. This evaluation should address upstream and downstream adult and juvenile passage. Consideration of spill, flow attraction, temperature and other issues affecting passage should be included. This evaluation should be discussed with the relicensing participants in the Alternative Licensing Process, including NMFS and FWS. Nothing in this RPM waives or limits FWS' or NMFS' Section 18 fishway prescription authority under the Federal Power Act.

4. FERC shall direct PacifiCorp and Cowlitz PUD to evaluate the feasibility of reestablishing bull trout passage at Swift No. 1 dam. This evaluation should address upstream and downstream adult and juvenile passage. Consideration of spill, flow attraction, temperature and other issues affecting passage should be included. This evaluation should be discussed with the relicensing participants in the Alternative Licensing Process, including NMFS and FWS. Nothing in this RPM waives or limits FWS' or NMFS' Section 18 fishway prescription authority under the Federal Power Act.

The following term and condition is necessary for the implementation of FWS RPM 3.

1. Within 30 days of the FERC issuance of the final orders approving the applications to amend licenses, FERC shall direct PacifiCorp and Cowlitz PUD to develop a plan to evaluate the effects of entrainment on bull trout at Swift No. 1 turbines. This information will be extrapolated to Yale and correlated to population sizes at the two reservoirs. Critical information on bull trout entrainment and distribution, timing, and usage is needed to minimize the effects of the project on bull trout. This plan should be coordinated with the relicensing participants and approved by FWS.

The following term and condition is necessary for the implementation of FWS RPM 4.

1. In carrying out Article 51, the FERC shall direct PacifiCorp to partially fund and continue their participation in the monitoring activities for bull trout in the North Fork Lewis River basin. Proposed funding levels, activities and methods shall be developed in cooperation with the appropriate agencies and provided to the FWS and NMFS for review before implementation. These include the Cougar Creek, Pine Creek and Rush Creek bull trout spawning surveys. Results of the various bull trout monitoring activity

shall be provided to the FWS annually as directed by FERC in their amendment order to Article 51 of the Merwin license.

The following term and condition is necessary for the implementation of FWS RPM 5.

1. FERC shall direct PacifiCorp to monitor habitat within the proposed conservation easement prior to bull trout spawning migration in Cougar Creek to assure that no detrimental changes have occurred due to upland management activities and /or winter storm damage.

The following term and condition is necessary for the implementation of FWS RPM 6.

1. FERC shall direct PacifiCorp to develop a road maintenance plan within the Cougar Creek conservation easement, and a schedule for implementation of the plan that meets the current Washington State Forest Practices Act. This plan shall be developed in consultation with FWS, WDFW and NMFS and shall be the basis for the repair and/or closure of roads on the newly acquired lands in the Cougar Creek drainage. Such plan shall include closure of the road that forms the southeast boundary of the Cougar Creek conservation easement to all vehicular access except maintenance equipment.

The following terms and conditions are necessary for the implementation of FWS RPM 7.

1. FERC shall direct PacifiCorp to complete testing of TDG at Merwin and Yale to determine if State water quality standards are being met and, if they are not being met, to develop a schedule and methods as part of new licenses to bring the projects into compliance to the extent needed to minimize the take of bull trout.

2. FERC shall direct PacifiCorp and Cowlitz PUD to complete testing of TDG at Swift No. 1 and Swift No. 2 to determine if State water quality standards are being met and, if they are not being met, to develop a schedule and methods as part of a new licenses to bring the projects into compliance to the extent needed to minimize the take of bull trout.

3. The FERC shall direct PacifiCorp to implement operational constraints at Merwin Dam intended to minimize adverse effects of rapid and severe river flow fluctuations on anadromous fish, including year-round minimum flows and ramping rates, seasonal water management, conducting studies to monitor the adequacy of the constraints, and providing for modification of the operational constraints depending on study results.

The following terms and conditions are necessary for the implementation of FWS RPM 8.

1. FERC shall direct PacifiCorp and Cowlitz PUD to develop annual implementation plans to implement the measures contained in this Opinion or until new licenses are issued. Further, FERC shall direct PacifiCorp and Cowlitz PUD to coordinate with the FWS and NMFS on the proposed annual plan in sufficient time to allow review and discussion prior to implementation.

2. In carrying out Article 49 of the Merwin License, FERC shall direct PacifiCorp to coordinate with the FWS and NMFS, and the affected state agencies, in preseason planning and in-season management of water management operations.

Term and Condition Specific to Anadromous Salmonids

The following term and condition specific to anadromous salmonids is necessary for the implementation of NMFS RPM 1

1. Within 30 days of the FERC issuance of the final order approving the application to amend the license, FERC shall direct PacifiCorp to provide documentation to verify the purchase of Eagle Island and name the agencies responsible for the ownership and maintenance of the property.

The following term and condition specific to anadromous salmonids is necessary for the implementation of NMFS RPM 2

1. Within 30 days of the FERC issuance of the final order approving the application to amend the license, FERC shall direct PacifiCorp to alter their ramping rates to meet a limit of 0.5 feet per three hour period and with the additional limit to down-ramping of only 2 inches per hour and revise up-ramping rate to 1.5 ft. per hour.

The following term and condition specific to anadromous salmonids is necessary for the implementation of NMFS RPM 3.

1. Within 30 days of the FERC issuance of the final order approving the application to amend the license, FERC shall direct PacifiCorp to demonstrate implementation of equipment and operating procedures to prevent future occurrences of lower river and adult salmon trap de-watering.

The following term and condition specific to anadromous salmonids is necessary for the implementation of NMFS RPM 5.

1. Within 30 days of the FERC issuance of the final order approving the application to amend the license, FERC shall direct PacifiCorp to work with the ALP to conduct studies to be completed during interim period, which are necessary to determine appropriate long-term operations with reduced levels of incidental take (see Table 3).

REPORTING REQUIREMENTS

The Services' are to be notified within three (3) working days upon locating a dead, injured, or sick endangered or threatened species specimen. Initial notification must be made to the nearest U.S. Fish and Wildlife Service and National Marine Fisheries Service Law Enforcement Offices. Notification must include the date, time, precise location of the injured animal or carcass, and any other pertinent information. Care should be taken in handling sick or injured specimens to preserve biological materials in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered or threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. Contact the FWS Law Enforcement Office at (425) 883-8122 or the FWS Western Washington Office at (360)753-9440 or the NMFS Law Enforcement Office at (360) 418-4246.

In order to monitor the effectiveness and impacts of implementing the reasonable and prudent measures, FERC shall direct PacifiCorp and Cowlitz PUD to prepare a report describing their progress in implementing the license terms and conditions (50 CFR §402.14(I)(3)). The progress report shall be submitted to the Western Washington Office of FWS and the Portland office of NMFS each year prior to March 31. The report shall discuss PacifiCorp and Cowlitz PUD's progress on the RPMs and document and discuss any incidental take during the preceding year. Included should be any activities in the conservation easements, results of studies that bear on the information gaps discussed above, any changes to operations that improve or protect the species or their habitat, and any plans for the next year's activities.

The amendment to article 51 requires PacifiCorp to file results from the annual monitoring with the FWS and the Commission on an annual basis. The report shall be filed annually with the FWS and the Commission within 60 days of its completion, and include any comments from the Washington Department of Fish and Wildlife and the U.S. Forest Service. (Note: these two agencies are major cooperators in the annual bull trout monitoring in the North Fork Lewis River.) The annual monitoring required by article 51 is discussed in Term and Condition 1 and the specifics required in that article may be coordinated with the annual report described above.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, help implement recovery plans, or develop information.

1. Coordinate with the WDFW and fund a creel census to document angler use, the type of gear used, fish identification proficiency, catch rates, and catch composition in the project area for at least the next two years. Methodologies for sampling and reporting recreational creel surveys should be consistent with previous creel census done for relicensing.

2. Continue to post interpretive signs to educate anglers on identifying and conserving native char (bull trout/Dolly Varden). These signs should be placed to inform anglers on how to carefully release fish (catch and release methodologies) and the benefits of using barbless hooks and no bait. These actions should help minimize incidental hooking mortality of bull trout. Since there are several fish species in Swift and Yale reservoirs, the interpretive signs need to clearly distinguish native bull trout from other species.

3. Work with the WDFW to reduce the risk of angler harvest of bull trout in the Swift No. 2 canal and the upper reservoir.

In order for the Service's to be kept informed of actions minimizing or avoiding adverse effects of benefitting listed species or their habitats, the Service's request notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation for the proposed license amendment and operations of the Lewis River hydroelectric projects as outlined in your October 4, 2000, request for consultation. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or, (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, FERC must notify the Services and reinitiate consultation [50 CFR §402.14(i)(4)].

This biological opinion has been framed in terms of the period of time extending from the present through 2006, the date identified in the ALP for completion of studies and development of a long-term settlement package. At that time, the Services expect that a subsequent consultation on the new licenses would supersede this opinion. This biological opinion assumes that to the extent that studies required in this biological opinion identify additional mitigation measures, such mitigation will be included in the BO for the new license and implemented during the new license term. Starting annually on April 2006, if FERC has not issued new licenses, the Services shall analyze PacifiCorp and Cowlitz PUD's annual report to determine if re-initiation of consultation is required. (See four factors pursuant to 50 CFR §402.16 in the preceding paragraph) If the Services determine that re-initiation is warranted, PacifiCorp and Cowlitz PUD consent to the consultation and shall remain in compliance under the current ITS until consultation is completed. If the Services determine that re-initiation is not required, PacifiCorp and Cowlitz PUD shall remain in compliance under the current ITS.

If consultation is reinitiated for any of the above reasons, the FERC shall not make any irreversible or irretrievable commitment of resources which has the effect of foreclosing the formulation of reasonable and prudent alternatives.

If you have any questions regarding this biological opinion, please contact Gene Stagner (360 753-4126) or Jim Michaels (360-753-7767) of the FWS or Keith Kirkendall (503) 230-5431 of the NMFS.

Sincerely,

for Ken S. Berg, Manager
United States Fish and Wildlife Service
Western Washington Fish and Wildlife Office

D. Robert Lohn, Regional Administrator
National Marine Fisheries Service

cc: PacifiCorp (F.Shrier)
Cowlitz PUD (D. MacDonald)
FERC (J. Hastreiter)

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